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Electrical World

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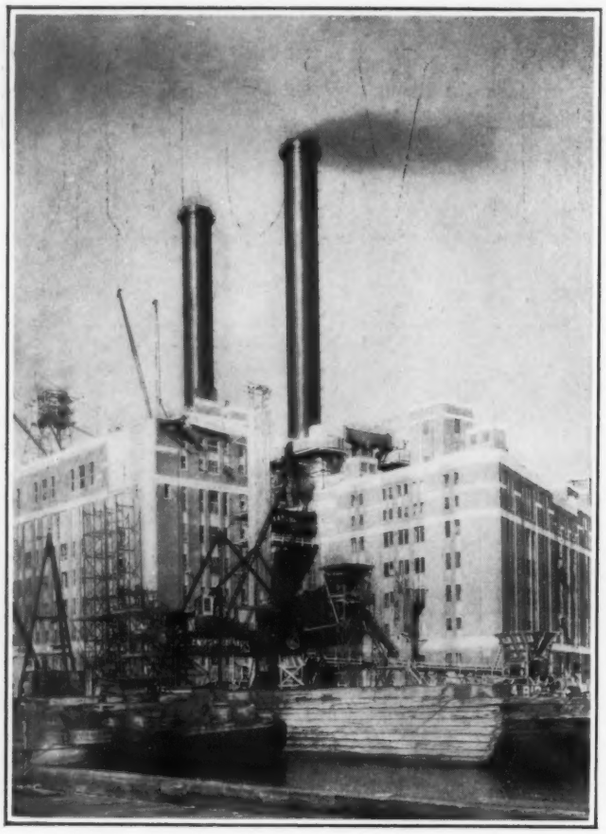

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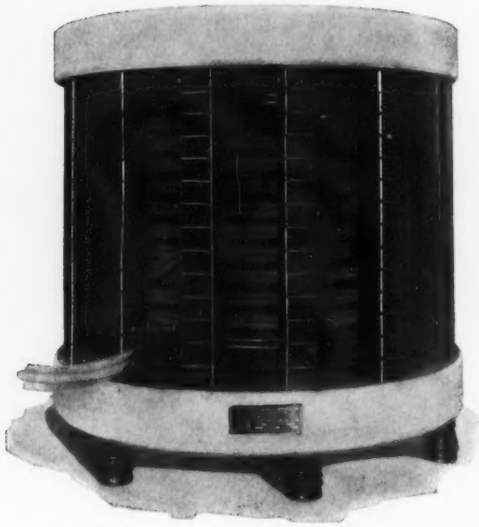

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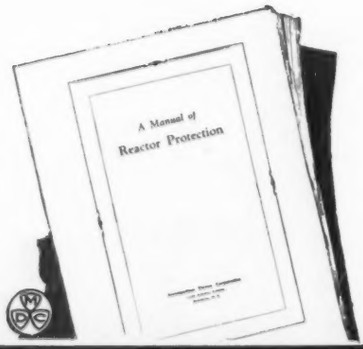

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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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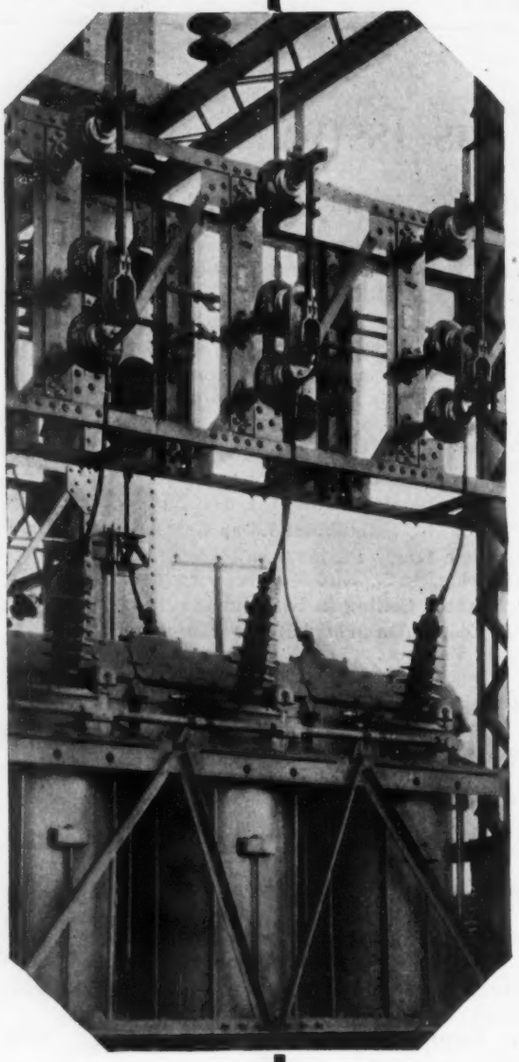
YEARS AGO



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Our engineers simply made these units right before going into production; a policy of doing all experimental work first, rather than let the purchaser do it.

In the end it has proved economical for both the factory and users. It is interesting to note that those who purchased Unit Type years ago can secure replacement parts made today which interchange with the original parts.

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Improvements have been made as the art progressed, such as increased porcelain strengths. For example, better grade porcelain and its utilization has resulted in higher factors of mechanical safety but the dimensions have been standardized all these years.

Can you recall any other type of equipment which has not required more or less radical changes since first offered to the industry?

A. W. Young

President

Delta INTERCHANGEABLE UNIT TYPE INSULATORS Star

DELTA STAR ELECTRIC COMPANY, 2400 BLOCK, FULTON ST, CHICAGO, ILLINOIS.

Electrical World

Published by McGraw-Hill Publishing Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 89 — *New York, Saturday, April 30, 1927* — NUMBER 18

Army Engineers Should Be Consulted on Colorado River Problem

APPLICATION of the resources of the Colorado River to the benefit of the public is largely an engineering problem. It is a matter which affects the entire nation as well as the states of the Colorado Basin, because it involves engineering and economic principles of great moment to the whole country.

In view of these facts and of the great concern of the federal government in the proper solution of the Colorado River problem, it seems strange that the advisers recently appointed by Secretary Work included no one of the federal engineers who advise the government on matters pertaining to navigable streams. Congress will consider no bill pertaining to engineering matters on the Colorado until it has heard all that representatives of the Corps of Engineers want to say. It passes few bills involving matters within the purview of that department over the head of the Chief of Engineers. To include an army engineer in this board would seem to have been advisable as a matter of practical politics, as well as for the purpose of using the experience and intelligence supplied by Congress for executive guidance.

It may be that the explanation lies in the situation which has been created by the effort to establish a Department of Public Works. This plan carries with it an aggrandizement of the Department of the Interior. Whether or not it is desirable is not of importance in connection with the Colorado situation, but it should not influence action. The army engineers are credited with being against the Public Works Department plan, and so it may be that friends of the plan, including Secretary Work, have no use for army engineers. The appointment of additional advisers on the Colorado problem is under discussion, but indications favor the prediction that no officer of the Corps of Engineers will be chosen. Would a private corporation investigate an engineering matter without calling upon its own engineer?

Why Our Natural Resources Remain Undeveloped

THE "Power Trust," whose gaunt specter is presumed to haunt the legislative halls of our national and state governments, is now being made to carry the blame for the shortcomings of many of our illustrious statesmen. But for it Muscle Shoals would long since have been disposed of, the sound of the air drill would be echoing and re-echoing through Boulder Canyon and the cascades and rapids of the St. Lawrence and other New York streams would be quiescent pools contributing millions of dollars toward the support of a prodigal state administration. Poor phantom, indeed, to be thus maligned! A trust, non-existent and yet all-powerful, to work its will on Congress and the state assemblies!

Do the demagogues really believe that they can delude their constituencies and the public at large and cover up their own obstinacy and shortcomings by such conjury? Vain hope! Diligent search has failed to uncover any such thing as a power trust. If the people of California want to know why the high dam on the Colorado is not being erected, let them inquire of Hiram Johnson. His obstinacy and not the opposition of any phantom power trust is the answer. Muscle Shoals —more's the pity—has become the political football of a so-called progressive but impotent group in Congress, and New York's water powers remain undeveloped because the astute "Al" Smith has used them to place in escrow an option on a presidential nomination. No, private industry has not retarded these developments; on the contrary, it is a matter of record that long ago private industry offered to harness these water powers at its own risk and expense. The genius and statesmanship of the electric light and power industry in its attitude toward the country's natural resources have been constructive and sympathetic. It now remains to be seen whether those who have hitherto obstructed their development and the continued industrial prosperity contingent thereon will measure up to their opportunities and responsibilities and diligently and liberally encourage the utilization of these natural resources to their own credit and the nation's good. Nothing less is expected of statesmen.

Interpreting Unit Costs

FEW indeed are the engineers whose enthusiasm has never been fired by the appeal of unit-cost analysis. Without it the electrical industry would steer a hard course through seas of figures too deep for quick penetration. The need of such data was never so great, but unit costs have limitations which are not always realized in the pressure commercial engineering exerts, especially upon the younger practitioners.

Take the classic example of cost per kilowatt of generating-plant rating. This is a common yardstick, of value to the investment banker, company director, executive, designing engineer and publicity man. It is a measure of successful development, but, like many instruments of precision, it must be used with skill and understanding to yield the best results. In practice this means that the total included items should be known, realized and, if necessary, specified in making use of such unit data, and the same point, of course, applies to other cost quotients of interest to the electrical engineering industry.

In a typical case a steam plant of 67,000-kw. initial rating cost $194 per kilowatt. Extended to 350,000 kw., this figure dropped to $134, and had the ultimate plant of 500,000 kw. been built at the time, the unit cost would have been about $121. There is nothing new in the diminution of unit costs with increase of capacity, but the use of any one of these three figures is limited

by the necessity for their qualification in statements embodying them, whether for the purpose of security issue regulation, comparison of designs among engineers interchanging data, checking the construction man's efficiency or telling the public about the high-grade job which has been done in its service. The same condition applies to such items as cost per kilowatt-hour delivered at the bus, including or excluding overhead and energy required for auxiliary purposes; to the manufacturing cost per unit of product shipped, to annual revenue per residential customer, and to yearly sales per capita of population as of a stated date or averaged through a specified period.

Combined with due consideration of total costs, graphic charts, tabular data and qualifying footnotes, unit costs fill a place of impregnable strength in economic analyses of industry operations. Their preparation cannot be allowed to become mechanical, however, without danger of their misinterpretation, and the facility of slide-rule computations ought never to be allowed to obscure the importance of "100 per cent control" at every step in cost analysis and its applications.

Convenience Outlets and Residential Electrification

FIVE years ago the wired homes in this country had an average of two and one-half convenience outlets each. A large proportion of these were in houses recently built. In fact, millions of apartments had no more than one convenience outlet and millions of houses had none. It is difficult to realize that there still are numberless wired homes in this country without them. In 1925 the average number of such outlets per wired home in this country was three and four-tenths. The gain of approximately one in the grand average in two years is entirely due to the higher wiring standards advocated by the electrical interests and introduced in new homes built during that two-year period.

When the movement for more convenience outlets was first begun, conservative recommendations for convenient wiring included nine outlets for a six-room domicile. Of course, electrical homes for exhibit purposes had a score or more of such outlets, most of which were justifiable. For several years the campaign for more outlets in new residences has been under way, with the result that ten to fifteen convenience outlets are now commonly installed. Where the electrical and building interests are active there is little complaint about wiring progress in new houses and apartments. The householder has profited by the greater convenience in the use of portable lamps and appliances.

But, let it be repeated, there are millions among the older houses and apartments which still have only one or two, or even no, convenience outlets. Many of these are in the smaller cities and towns where they will house prosperous families for years. What is to be done with these? A casual survey of such homes shows very few portable lamps in use, and appliances are correspondingly rare. Convenience outlets are particularly easy to install in homes, and campaigns in the smaller towns should be made to bear fruit. Certainly, electrical development in most smaller cities and towns will be very slow until convenience outlets are supplied. The central-station company should look at this as a distinctly different problem in the smaller communities from what it is in the urban and suburban districts.

Why Not Sell Industrial Heating to the Actual Users?

USERS of equipment are the ultimate buyers. It makes no difference whether it is the man in the front office who gives the order and signs the check in payment, the men out in the shop are the ones who determine whether the equipment is going to stay sold and if any repeat orders are to be made. In no other field has this fact been more apparent than in industrial electric heating. For example, there are not a few instances in which electric heating devices and equipment have been sold to factory executives, have been installed and have later been allowed to accumulate dust or have been jerked out, depending on the terms of the contract of sale. Examination of some of these fiascos may disclose fallacies in selling procedure that will prevent them in the future.

The achievements of one or two electric service companies in selling industrial electric heating indicate that these companies have apparently found a successful formula. If they have a potent charm which others have not yet discovered, that charm has undoubtedly been extracted from the realization that selling an electric furnace to an executive does not mean that the furnace has been sold to the men who will operate it. The operators of furnaces and heating devices are not only the plant superintendents and the foremen. They include even the laborers who trundle cars and wheelbarrows, who tug and push and sweat to keep the things going. If these men find that through poor construction, improper relationship to other processes or inconvenient operating requirements, the electric furnace or oven makes their work harder, they may never tell the boss about it in words, but they will tell him about it in lower production and higher costs.

Out to make a name for himself in building up the industrial heating load of his company, the wide-awake power salesman knows that the equipment the customer buys must be satisfactory in every way. He realizes that he must be certain, not only of the qualities and capacities of the equipment, but of its capability of fitting into the normal shop processes and of its physical characteristics that affect the men who will operate it. He must have "gumption" enough to speak out emphatically and tell convincingly why he thinks the equipment will be satisfactory, if he does think so, or else turn down the idea entirely if he is not certain that electrical equipment will work. He will remember that some heating loads have been lost because certain previous installations have not been justified. There are plenty of electrical applications that can be justified economically without risking the promotion of those having doubtful economy.

Estimates of the possibilities and potentialities of industrial heating or electricity systems have been freely made by many men. They are often so great as to excite skepticism rather than enthusiasm in the minds of those not familiar with the field. But to those companies that now have heating loads equal in connected capacity to 15, 20 and 25 per cent of their power loads and who expect to make these proportions 50 or 100 per cent in a few years such estimates are cold reason and not heated fancies. Some companies have stated that only through development of electric heat application can they hope to maintain the large percentage increases in industrial business that have characterized it in years past.

We Measure Ourselves

COMPARISON of American and European statistics on the electrical industry reveals a notable difference in the amount of information available on the two sides of the Atlantic. It has been the habit to think of the western European countries as devotees of the practice of tabulating, indexing, accounting and analyzing the activities of their people. So far, at least, as the electrical industry is concerned, this is far from being the case.

The United States Geological Survey publishes monthly statistics on the energy output of every state in the Union within five or six weeks after the close of each calendar month, as well as on fuel consumption of various kinds, and in addition issues other statistics at frequent intervals on such matters as plant capacity and hydro-electric resources and their development, so that we have a constant measure of the progress of the industry. No such up-to-the-minute information seems to be available for European countries, though Canada's practice is in many ways similar to that in the United States. Likewise, there seems to be no European parallel to the detailed financial and operating statistics published each month and annually in the ELECTRICAL WORLD. These data are made possible by the voluntary co-operation of almost 90 per cent of the electric light and power industry.

It is doubtful whether the American people in general realize the extent of electrical statistical knowledge and the resulting benefits of this national functioning of a most important basic industry. It is one of those factors in our existence that cannot well be evaluated separately, but which in the aggregate make the difference between a highly individualistic and a co-ordinated scheme of existence. It helps us to know where we stand, and therefore to plan intelligently for the future.

Is the Motor Manufacturer Interested in Control?

MANUFACTURERS who build control apparatus fully realize the importance of control equipment in motor applications and accordingly they devote much effort to selling combined equipments which will meet the needs of each buyer. But several motor manufacturers are not sufficiently interested in control and are concerned entirely with selling a motor. This policy, unconsciously tends to bring about definite sales resistance.

The motor manufacturer should not feel that he is exhibiting an altruistic motive if he "sells" control equipment with his motor. Rather he is making it easier to sell his motors if his sales policy is worked out on the basis of a motor application which must include a full knowledge of the proper control adapted to meet the buyer's needs. There have been occasions when a salesman has entered a field only because he happened to hear of a fairly large inquiry for motors. He is entirely unacquainted with the control problems and the proper application of the motors in that industry, but he sets out to capture the order. If he secures the business only because his price is extremely low, he demoralizes the market and renders poor service to the customer. But if the salesman is familiar with the industry and its problems and tries to sell a definite motor application with an understanding of the motor and control requirements, the motor sale, if made, will be closed on a better basis and the salesman will have rendered the best possible service to the buyer. When a motor manufacturer begins to "sell" motor applications he will build up his business on the firm foundation of rendering a real service to the industry.

Supreme Court Supports Unrestricted Commerce

A RECENT decision of the United States Supreme Court in the Bedford stone case and the decision of the Decorative-Stone case in a United States District Court have a very direct bearing on the electrical industry. The attitude of the labor unions in requiring that electrical fixtures bear the union label or else be shipped unassembled and wired by union labor at the point of installation closely parallels the stone cases, in which the right of the manufacturer to a free and open market for his goods was clearly indicated. These decisions open a lane that for years has been closed, and a precedent has now been established whereby the manufacturer can stop this attempt on the part of organized labor to dictate under what conditions he shall make and market his goods. For, although the situation with regard to lighting fixtures affects directly only a relatively small group of manufacturers and is financially of no great significance, there is a natural fear that it will prove a stepping stone to the application by the union of similar rulings to the other equipment. Industry and labor both have a right to organize and to conduct their own affairs, but this implies no right of either to place a restraint upon the other or for either to exploit the public for selfish purposes.

Unfortunately, the union has been aided and abetted by some contractors with the ulterior motive of securing for themselves more work. And the matter is not even confined to the union label issue. What economic factors can be advanced to justify the situation in Chicago, where under the union rules only conduit wiring can be installed in residences and where armored cable cannot be used in residence wiring? Not so long ago a similar resolution was presented to the New York labor union demanding that no armored cable wiring should be installed in residences wired within the jurisdiction of that union. The resolution was not acted on, largely owing to internal difficulties in the union. But it is only a question of time when action will be taken.

The industry must look this problem squarely in the face and realize that such dominance by the labor unions would threaten its entire economic structure and if once given a foothold would spread far and rapidly. Adequate means for preventing this encroachment upon electrical manufacturing and distributing methods are now in the hands of the industry, having been placed there by the court decisions in the stonecutters' cases, and full use should be made of them before the tide becomes too strong to be stemmed. Either the manufacturers or the Department of Justice may act, and the police remedies are injunctions, treble damages, criminal prosecutions or all three. But of greater importance than legal battles is the education of both sides so that a fair attitude shall be held by manufacturers and unions toward the public and each shall understand that only as industry as a whole goes forward and develops will each reap the benefits of its labors and investments.

Herbert Eugene Ives

A physicist whose study of the photo-electric cell played a large part in making television possible.

HERBERT E. IVES has behind him many years of fruitful research into physical problems. After graduation from the University of Pennsylvania in 1905, he studied three years at Johns Hopkins, receiving the degree of doctor of philosophy. During the next ten years as research physicist for a number of organizations, including the Bureau of Standards at Washington and the Nela laboratories at Cleveland, he developed, among other things, an "artificial eye" for use in photometry, a method for the description of colors in precise numerical terms and a practical lamp for the production of artificial daylight. This lamp is now in general use in retail stores for color comparisons. Another elaborate research was the demonstration of the "mechanical equivalent of light," a fundamental factor in comparing efficiencies of lamps of different kinds. Early in his career Dr. Ives took up the study of the photo-electric cell and applied it to a simulation of the eye for experimental work on the human response to light flashes. Conclusions drawn from this study have been applied in the development of the television system.

As a captain in the Signal Corps, Dr. Ives during the war had charge of three laboratories for the development of airplane photography. His book on this subject is considered a classical work in its field. Returning to civil life, he entered the Bell Telephone Laboratories. When Bell System executives decided that the time was ripe to develop a practical picture-transmission system, Dr. Ives' experience indicated his fitness to be placed in charge of the work. In addition to general supervision, Dr. Ives was specifically responsible for the optical aspects of the problem and for the photo-electric cell. He also continued the study of photo-electric cells and of related problems which have led up to the present development of the television system.

Dr. Ives was born in Philadelphia, the son of Frederick E. Ives, a distinguished scientist and inventor of the halftone process of reproduction. During his own career Dr. Ives has performed a large volume of constructive research, to which more than a hundred scientific papers bear witness. He holds three medals from the Franklin Institute for his work in various optical fields, and numerous patents have been awarded to him. He is a past-president of the Optical Society of America. Dr. Ives lives in Montclair, N. J.

High-Voltage Substation Design*

Practices of the Detroit Edison Company—Insulation, Drainage and Construction Arrangements Discussed—Reliability and Simplicity Stressed in Designs

THE initial step in the design of an outdoor substation is to decide upon the present and ultimate requirements as to capacity. This question settled, another arises: Should it be a single or double-bus station? The answer depends greatly upon the transmission system and the purpose of the station. Most of the substations on the transmission system of the Detroit Edison Company are of the single-bus type. At Trenton Channel power house, which will have an ultimate capacity of six 50,000-kw. generators, double-bus construction is required on account of short circuits, division of load and voltage regulation. Some of the generators and lines have two circuit breakers; the others are equipped with a single breaker. This arrangement provides the flexibility that may be required. A double bus is provided at Shelby. At present this is a line switching station and is designed on plans for a future generating station. Our experience has been that cases of bus trouble are very remote, and therefore we design our step-down stations with a single bus.

Single buses are in two sections (Fig. 1), designated as Buses No. 1 and No. 2. All transmission lines are double circuit and are designated by naming terminal substations and numbers 1 or 2 as the case may be. All No. 1 lines are attached to No. 1 buses and No. 2 lines to No. 2 buses. With this arrangement all buses are electrically a part of the lines, and with the section switches open all lines numbered 1 are continuous throughout, as also are the lines numbered 2. With generating stations at both ends of the transmission system it is possible to shut down one section of the bus without the separation of the power houses. The

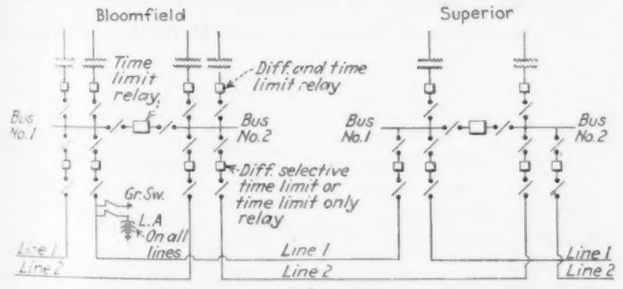


FIG. 1—OUTDOOR SUBSTATION SWITCHING ARRANGEMENTS FOR DETROIT EDISON COMPANY'S STEP-DOWN SUBSTATIONS. A SINGLE BUS IN TWO SECTIONS IS USED

arrangement described also permits short circuiting of sections of the line for melting ice that may form on the conductors.

The columns and girders in the substations of the Detroit Edison Company are of latticed steel, 4 ft. square. The steel is designed for a snow and ice load of 50 lb. per linear foot on girders and a transverse wind load of 15 lb. per square foot on one and one-half

*Based on a presentation by S. M. Dean of the Detroit Edison Company, at a symposium on this topic under the auspices of the N.E.L.A. apparatus committee, February, 1927.

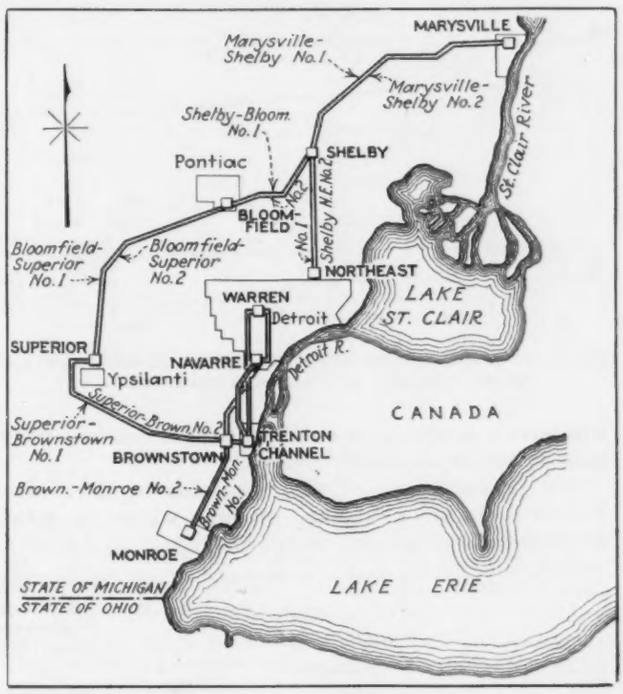


FIG. 2—THE 120,000-VOLT TRANSMISSION SYSTEM OF THE DETROIT EDISON COMPANY. IN ADDITION TO THE TRENTON CHANNEL AND MARYSVILLE GENERATING STATIONS THE LARGE STEP-DOWN SUBSTATIONS ARE INDICATED

times the projected area of columns and girders. The maximum allowable stress used is 24,000 lb. per square inch. This provides a good safety factor.

Stick-operated disconnects are now a thing of the past in high-voltage stations. The gang-operated switches are in common use. Where gang-operated disconnects are mounted on the main structure, the loading is increased by 100 per cent to take care of the impact when closing or opening switches.

Transformers, circuit breakers, disconnects and lightning arresters are mounted on independent concrete mats. Crushed stones are laid over the entire substation between mats to a depth of about 9 in. All steel columns are anchored to concrete foundations.

Selecting the most economical voltage is the first step in the design of a transmission system. This determines the size of conductors, considering the losses and corona, which in turn determines the most economical span and sag. The minimum allowable ground clearance and the sag being known, the height of the top conductor is determined and from that an average elevation for the conductors. This elevation determines very roughly the induced lightning voltages that one may expect to encounter. These voltages being known, it becomes a matter of evaluating ground wires as against additional insulators, and in practically all cases in the 132,000-volt class it proves advisable to use at least one

ground wire. Tower clearances are dependent on voltage and span lengths.

Insulator strings, stacks and bushings for use in high-tension substations should be selected with due regard to transmission line insulation. The insulator strings in the station should have a higher flashover value than those on the line, otherwise all "spillovers"

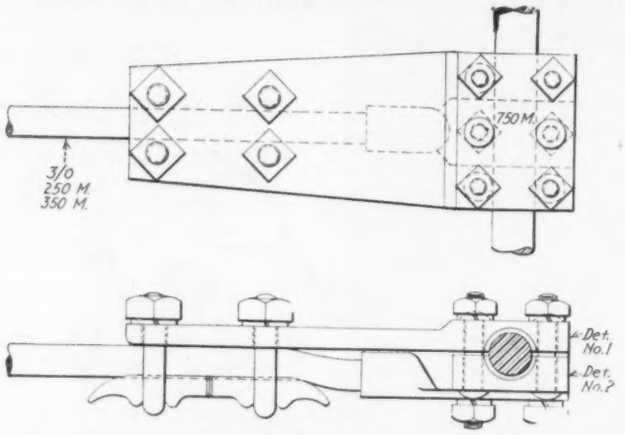


FIG. 3—BUS CONNECTOR USED BY DETROIT EDISON COMPANY. 750,000-CIRC.MIL RUN AND 350,000-CIRC.MIL TAP

will have a tendency to occur on the station bus, where they cannot be so readily cleared.

The proportioning of the insulation of the Detroit Edison Company's 120-kv. system, which is solidly grounded at the neutral, is approximately as follows:

Location	Type	Units	Lightning Flashover Voltage (Kv.)
Line	Suspension	9	1,100
Line	Strain	10	1,250
Station	Suspension	10	1,250
Station	Strain	12	1,450

Recent tests have been made that show that the usual maximum induced voltage on the top wire of a transmission line, the average height of which is 60 ft., is 1,200 kv., and that the probable maximum is 900 kv., provided the line is equipped with one ground wire.

A minimum clearance of 45 in. to tower is specified and the lightning flashover voltage for this distance in the air is 1,350 kv. The practice is to specify 154,000-volt disconnects. These disconnects are double-break, single-throw, horizontally mounted, with the exception of lightning arrester disconnects, which are single-break, vertically mounted. Transformers and oil circuit breakers are rated 132,000 volts. To specify 154,000-volt bushings on oil circuit breakers would mean flashover within the tank, unless the entire breaker is insulated for the higher rating. Such a breaker would cost considerably more than the 132,000-volt equipment. Due to the greater electrostatic capacity of the breaker as compared with that of the disconnect, it seems inadvisable to provide the extra insulation at the additional cost.

Ample clearances should be provided to prevent flashover between phases and to ground. Lead supports or guides should be used at bus connectors, transformer and circuit breaker terminals, and at disconnects to provide clearance between live parts and ground. On the Detroit Edison Company system a bus clearance of 10 ft. is provided between phases. Between center line of circuit breakers 12 ft. is allowed, and the same distance is maintained between phases at disconnects. A minimum of 5 ft. is specified between live parts and ground. This clearance is ample as compared with 45 in. on transmission towers as mentioned before. Crossovers are poor design and should be avoided if possible.

The relay scheme will vary at different substations, depending on the number of lines, arrangement of lines and importance of station. On our system we install reverse-power, inverse-time-limit relays at substations having only two lines. Where more than two lines enter a substation, we install differential selective and time-limit relays on lines. In emergencies where one of a pair of lines is down, the differential selective relays are inoperative and protection to the single line is provided by time limit only. At section switches time-limit relays only are installed. All transformers have differential protection over all and time limit relays on the high-voltage circuit breaker. (Fig. 1.)

All tower lines will soon be equipped with ground wires. All ground wires are of the same size and material as the conductors. To reduce ground resistance the ground wire is bonded to every tower by means of a very flexible short copper cable. Ground wires should terminate by attachment to the substation structure.

Lightning arresters should be installed on all lines in preference to the bus. This is the present practice of the Detroit Edison Company, and bus arresters are being moved to lines. Each arrester is equipped with a gang-operated disconnecting switch and is completely surrounded by a separate wire fence, even when located within the station fence line, since during a discharge the lower parts of the arrester, exposed to accidental contact with a passerby, may be alive.

The entire ground mass should be tied together in a solid network. All metal parts of equipment and structure that are at ground potential should be grounded to this mass. The practice of our company is to install a casting under every tower foundation. These castings are 6 ft. long and have a cross-shaped section to provide maximum surface. (Fig. 5.) All castings are connected together by two No. 0 copper wires. All line disconnects should be equipped with grounding blades for grounding the line when under repairs for protection to workmen.

The question of interlocks reverts to the intelligence

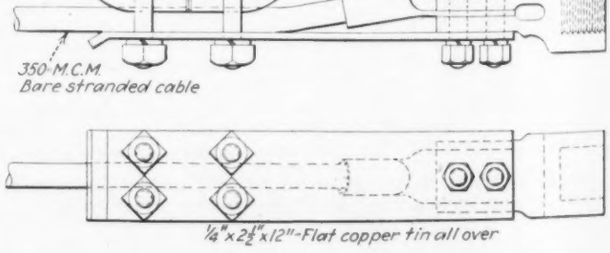


FIG. 4—TERMINAL CONNECTOR USED BY DETROIT EDISON COMPANY. 350,000-CIRC.MIL RUN

of the operators. When considerable interlocking is provided, the operator becomes a mechanical machine, whereas when interlocks are used sparingly, the responsibility of the operator must be relied upon. It seems advisable to provide a certain amount of interlocking. At double-bus stations electrical and mechanical interlocks are provided between the oil circuit breaker and the bus and line disconnecting switches.

At other substations there are mechanical interlocks between line disconnects and line grounding blades.

All substations should be provided with good drainage. The practice of the Detroit Edison Company is to bury drain tile along the side walls of all concrete mats. Drainage may be direct to the city sewer or through a sump. In the outlying territory it may be necessary to drain into a nearby ditch. (Fig. 6.)

Fire is not the hazard with outdoor as it is with indoor substations and the protection need not be so complete. However, some means should be provided to take care of burning oil in case of an explosion. The oil circuit breaker mat should be built with a longitudinal crown. A trough should be dug in the ground along both sides of the mat and filled with crushed stones. Burning oil will flow off the sloping mat and will extinguish itself while passing through the crushed stones. This is a very inexpensive method of protecting against burning oil. However, other means must be provided for protecting the substation house in case of fire, and at some of our outlying stations we are installing "Foamite" apparatus.

All high-voltage substations should be equipped with electrical remote-control switchboards. Panels should be located geographically with respect to outdoor equipment. A relay switchboard is installed in the rear of the instrument and control board.

Metering should be done on the low-voltage side of transformers. Kilowatt meters, reactive kilovolt-ampere meters, ammeters and voltmeters are located on the low-voltage side of all transformers. Ammeters are placed on all 120,000-volt lines taken off the circuit-breaker bushing-type current transformers. These current transformers also operate the relays.

High-voltage current transformers should be placed on the protected side of the oil circuit breaker, and potential transformers should be eliminated as much as possible, and when absolutely necessary for line-synchronizing purposes, should be protected by good fuses, not so much to protect the potential transformer as to protect the system from the potential transformer. The fuse should either be of the disconnecting switch type or should have a separate disconnecting switch in series with it.

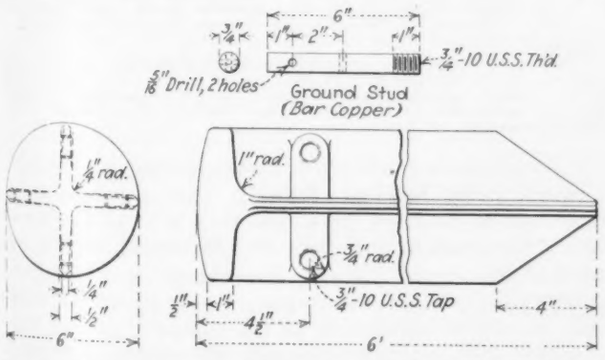


FIG. 5—CASTINGS USED UNDER EACH TOWER FOUNDATION OF THE DETROIT EDISON COMPANY

With the Detroit Edison Company, synchronizing is done on the 24,000-volt side of transformers, which eliminates the use of 120,000-volt potential units.

Control energy should be direct current supplied by a storage battery. A 7-kw. motor-generator set is used for charging the battery. Some of the switches are solenoid operated and others have motor mechanisms. Direct-current solenoid mechanisms, besides being of simple construction, more reliable in operation and more easily kept in repair, are more economical of space and power than the alternating-current mechanisms.

Although the original cost is greater for self-cooled than for water-cooled transformers, it may be more economical to install the former. With water-cooled transformers it is necessary to provide for a tunnel,

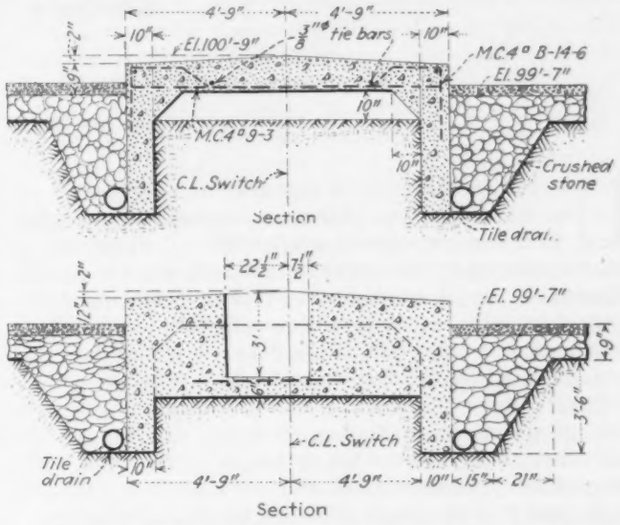


FIG. 6—OIL CIRCUIT BREAKER MAT SECTIONS WITH DRAINAGE ARRANGEMENTS USED BY DETROIT EDISON COMPANY

cooling system, pump house and possibly a cooling tower. Furthermore, self-cooled units may be transferred from one substation to another, which may not be possible with the water-cooled type. The efficiency of the self-cooled type is higher than that of the water-cooled, which is a very appreciable factor in the decision as to type.

House service should be provided by taps from two power lines fed from two independent stations, if possible. The practice in Detroit is to use two three-phase banks of transformers for stepping distribution voltage down to 220 volts. Single-phase transformers are installed to provide 110 volts.

Storage tanks of ample capacity should be located near the substation for storing transformer and circuit breaker oil. A stationary centrifugal oil purifier should be located in the basement of the substation house and permanent pipe lines installed from dehydrator and oil tanks to within about 25 ft. of the equipment. A flexible hose connection can be used between the ends of the pipe lines and the circuit breakers and transformers.

For removing foreign particles from the oil a portable filter press should be available. This press can be located temporarily near the piece of apparatus containing the oil to be filtered and is used in series with the centrifugal drier.

Permanent lighting should be provided over the entire outdoor substation for the convenience of operators in switching at night. Good lighting is also required for repair men who are compelled to work at night.

To facilitate the handling of heavy apparatus, a railroad siding should be installed along the substation, if it is located near a railroad. The transformers should be placed on a raised concrete platform that is on a level with railroad cars. Transformers should be purchased with trucks having flanged wheels of standard gage, and by installing permanent rails in the concrete platform the transformers can be moved from cars to platform on their own trucks.

Construction Methods and Control

System of Supervising and Controlling a Number of Standard Construction Jobs of Various Kinds and Sizes Which Is Used by the Duquesne Light Company Is Explained

By M. R. Sumner

Construction Engineer Duquesne Light Company

UP-TO-THE-MINUTE accounts of progress on all construction jobs, ability to determine the disposition and consequent availability of all classes of labor employed by the organization and, what is equally important, a job-expenditure record that is of inestimable value in maintaining efficiency in handling both men and materials in the field are afforded by the system* used by the Duquesne Light Company.

Charts and reports make up the "work control" system as practiced in the construction division of the company. It is believed the system is of the right sort; it adequately takes care of the work as it is intended to do, and it is as simple, it seems, as it can be made.

The scope of the work handled covers, briefly, system and customers' high-tension substations; underground electric conduit structures; buildings; steel towers; steel and concrete railroad bridges; steam-heating system extensions; coal-unloading towers; coal barges; coal-mine improvements; submarine electric cable crossings under the rivers; office buildings; appliance stores; electric system betterments; additions and improvements.

The work supervised and completed by the construction division in 1925 was valued at approximately $2,750,000. Its supervision is chiefly of interest because it consisted of so many individual relatively small jobs that were carried on simultaneously over an area of approximately 1,000 square miles, its center being the city of Pittsburgh. Recent progress reports indicate that there are more than 100 jobs in various stages of completion at the present time.

The "work order" system insures that the issuance of all new jobs shall be through one channel, and no work is permitted to be done unless authorized by a work order. It gives the chief timekeeper a means of checking labor charges, and by means of it the work dispatcher calls on all section heads or their representatives for a weekly or semi-monthly report as to the status of every project being handled by the construction division. With these data, reports and charts for the information of the chief engineer and the construction engineer can be readily prepared. A semi-monthly report is made by the electrical section because of the large number of jobs always in progress.

As a means of keeping a convenient record of the location of various crews of mechanics from week to week a "weekly crew line-up" report is made by the electrical section and by the building, underground and mechanical sections. The improvement program, in general, is guided by job schedules and load charts prepared by the production division of the engineering department.

Load-control charts, based on the estimated man-hours of work on hand and the man-hours of labor available, have proved to be helpful as a means of keeping informed about the volume of assigned construction work compared with the available forces of mechanics and laborers.

These charts are plotted each week for the "underground forces," the "electrical forces" and the "civil or building forces." A sample of the type of chart used is reproduced here.

The practical value of these charts is considerable; they show at a glance the degree to which the crews are loaded with work; they show whether or not new jobs are being handled efficiently with a minimum of interruption to other jobs, and they answer the question, "How much work has the particular section on hand at the present time?" The charts have been particularly helpful in determining the amount of work that should be contracted, as the company always supplements its own forces largely by resorting to contracting.

To illustrate the use of the charts and reports and their bearing on work control, let us assume that a new substation project has reached the stage wherein work can be started. This implies that a schedule has been set up, funds have been authorized, equipment ordered, plans are available and construction orders released.

Reference to the "work order" form indicates clearly

TABLE OF RECORDS KEPT

WEEKLY REPORT.—Civil, underground and mechanical sections; contract section, and electrical section. An enumeration of the status of jobs as completed, active or not yet started.

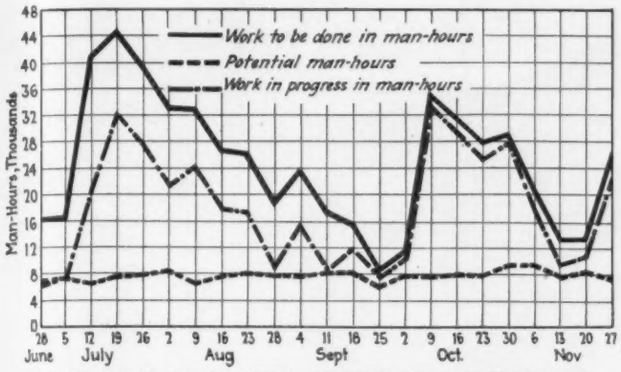
WEEKLY CREW LINE-UP.—A list of the personnel assigned to each job.

SEMI-MONTHLY REPORT.*—Electrical section, five divisions:
- A. Construction orders received.
- B. Construction orders previously received, not yet completed.
- C. Construction orders completed and closing letters sent.
- D. Construction orders held up and reason therefor.
- E. Financial status of construction orders.

WEEKLY REPORT.—Electrical section. Jobs started but not completed, including items: Work order number; account to be charged; description of work; date started; per cent completed last week and present week, and name of individual to whom charge of work has been intrusted.

*The most important part of this report for purposes of financial control is Section E. Typical items are: Total authorized fund; portion allowed each section; amount expended to date; amount estimated to complete work; indicated overrun or indicated underrun of estimate.

*This article was prepared prior to Jan. 1, 1927, at which date the engineering department of the Duquesne Light Company, including the construction division, was reorganized as the Pittsburgh branch of the Byllesby Engineering & Management Corporation, involving a number of changes in the function, scope, methods and forms of the construction division. This article is published, however, because of the possible interest it may have for others engaged along similar lines.



LOAD-CONTROL CHART USED TO EXPEDITE EFFICIENT DISTRIBUTION OF CONSTRUCTION FORCES

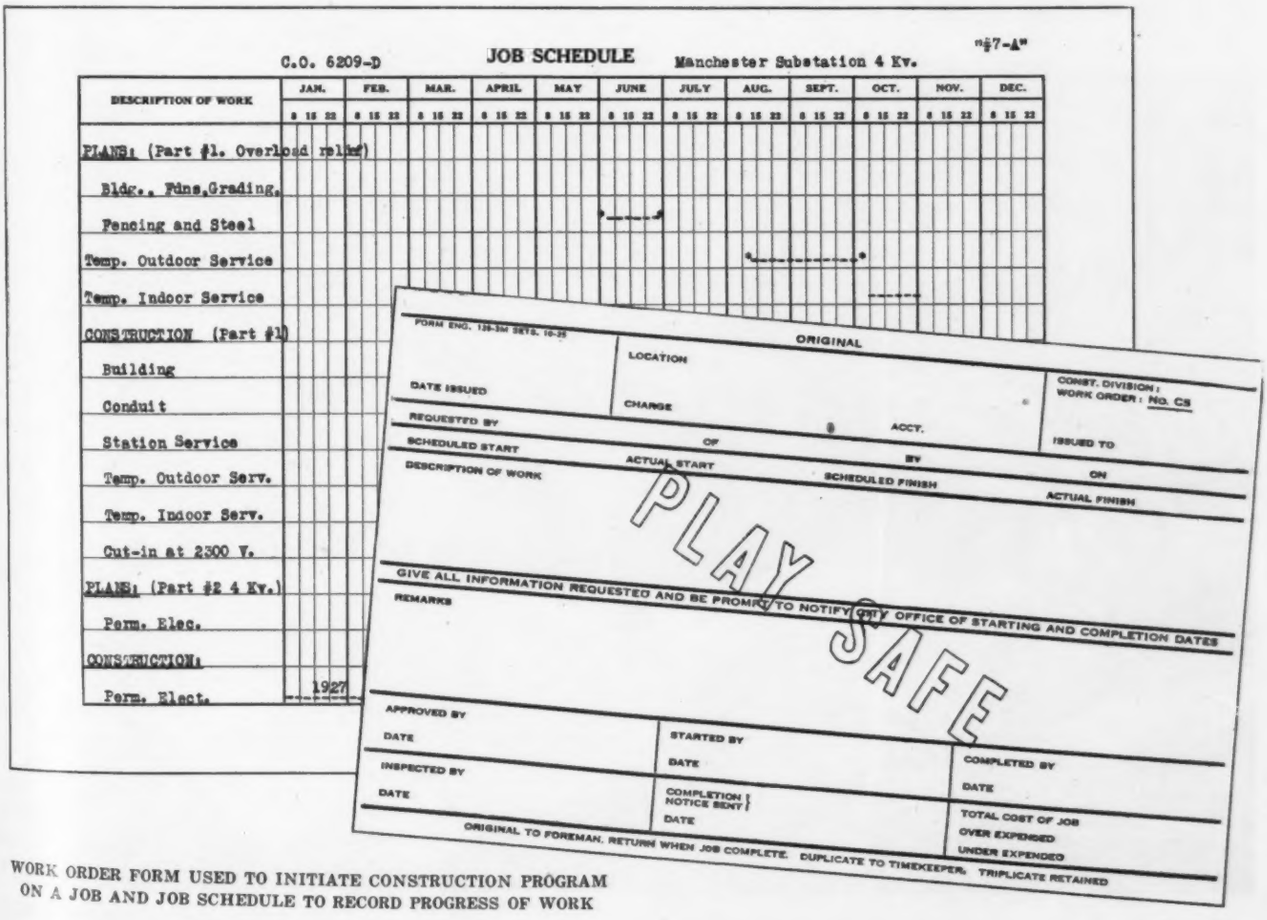
the nature of the information that is filled in by the "work dispatcher," who issues these orders. The reverse side of the form is ruled to record progress from week to week, with a column provided for indicating the condition of the work as a percentage of a finished job. The original form is issued to the superintendent who is to do the work; a duplicate is forwarded to the chief timekeeper, who uses it for checking the accuracy of time charged for labor, and the triplicate is retained by the "work dispatcher" for his preparation of weekly and semi-monthly reports on progress.

The "load control" chart indicates that all work can be handled by the company's own forces. "Work orders," therefore, are issued to the various sections, authorizing them to proceed with their portion of the work, in accordance with plans and instructions covering the job. The "weekly progress" report now enters into the system of control. The weekly meetings, during which the work is discussed, familiarize the foremen and section engineers with the various phases of the work. The report shows its progress and gives reason for delay, if any, so that proper steps can be taken to have the causes for such delay removed. It furnishes information so that all other elements of the project may be properly co-ordinated and controlled.

The financial statement included in the semi-monthly report is useful to section engineers and to the foreman having charge of the work. It answers the question, "How much money is authorized to complete the given job, how much has been expended, and is the balance sufficient to carry it through to completion?"

When the weekly progress report shows that a project is not progressing so rapidly as could be expected, reference to the "crew line-up" may indicate that another crew or a certain part of it may advantageously be transferred to the job in question; or, if the semi-monthly report shows an expenditure greater than was anticipated, the "crew line-up" report may also indicate that too many "A" mechanics, drawing a high rate of pay, are being used for the work in hand. Obviously, no advantage would be gained, from the standpoint of economy, in maintaining skilled electrical mechanics on work for which those possessing less skill could be satisfactorily employed.

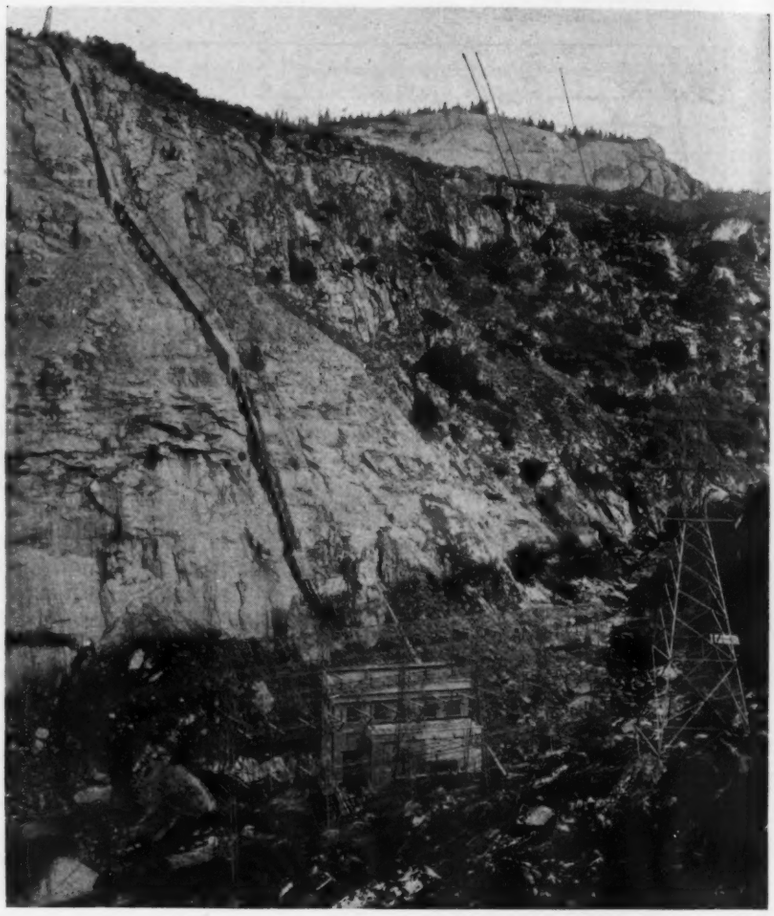
This system of work direction and supervision has been used with very satisfactory results by the Duquesne Light Company. It tells the whole story of a construction program, work on hand, availability of labor and its location, progress of the job from week to week, and expenditures.



WORK ORDER FORM USED TO INITIATE CONSTRUCTION PROGRAM ON A JOB AND JOB SCHEDULE TO RECORD PROGRESS OF WORK

2,243-Ft. Head Within 40 Miles of Market

THE Balch hydro-electric plant is unusual in that it develops a net head of 2,243 ft. within 40 miles of the company's market center. Over 19,000 ft. of pressure tunnel and nearly 5,000 ft. of penstock convey the water from storage to power plant, but the major portion of the total hydraulic gradient occurs in the last 2,286 ft. of penstock. This portion is made of banded steel pipe supported in an interesting manner. The power house is not situated directly at the foot of the canyon wall down which the penstock runs, but across the river therefrom. As a consequence the penstock crossing is imbedded in solid concrete in the river bed. These features and some of the means of guarding against excessive pressure rises in the penstocks and accidental opening of headgates are discussed in the following pages.



Balch Hydro Development

First Unit in 500,000-Hp. Project Is Completed —Is Within 40 Miles of Large Market Center— Banded Steel Penstocks Used for 2,243-Ft. Head

By J. W. Jourdan and C. P. Rhine

Designing Engineer and Electrical Engineer, Respectively, San Joaquin Light & Power Corporation, Fresno, Cal.

THE first unit of the Balch hydro-electric project of the San Joaquin Light & Power Corporation was officially placed in operation Jan. 29, 1927, almost exactly 22 months after construction was authorized. It is located on the North Fork of Kings River in east central California about 30 miles from Fresno and constitutes part of a development on the North and West Forks of the river that will ultimately have a capacity of 500,000 hp. The initial installation in the Balch plant consists of one 33,000-kva. generator driven by double overhung waterwheels of 20,000 hp. each, operating under an effective head of 2,243 ft. When finally completed, it will contain four 40,000-hp. units. The plant was built at a saving of approximately half a million dollars under the estimated cost of $3,764,000.*

Balch is the largest of the plants contemplated in the Kings River development and lies practically in the center of the development, at a distance of only 39 miles from Sanger substation, which in turn is located at the heart of the distribution system of the San Joaquin Light & Power Corporation in the San Joaquin Valley. This combination of circumstances is remarkable and is different from the usual conditions obtaining in the West, where large sources of power are generally far removed from the market, involving the expense of long-distance transmission. The plant has the highest operating head (2,243 ft.) of any plant yet to be constructed in this country, although there are two plants now building in California that will have slightly higher head. Because of this high head the type of penstock used and the safety precautions taken in handling the high hydrostatic pressures involved are of particular interest. Another feature that makes the plant outstanding among those in this country is the fact that the power house is located on the opposite side of the river from the penstock, involving some unusual engineering problems.

Five major considerations were kept in mind:

1. Permanence and durability.

*Construction economies on this job were discussed in an article on "Hydro-Electric Construction Practice on the Pacific Coast" in ELECTRICAL WORLD for Oct. 9, 1926, page 743.

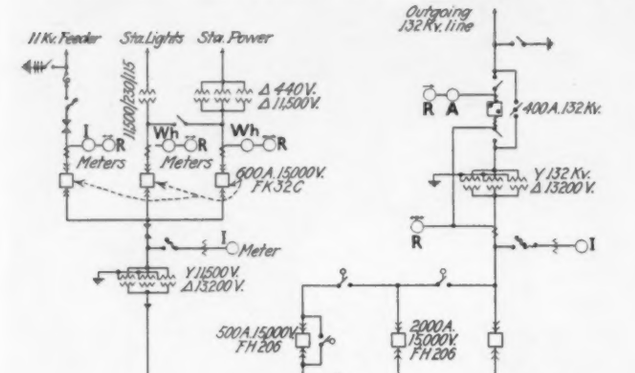
2. Safety and facility of operation.

3. Adaptability of design for initial construction to plans for the ultimate plant.

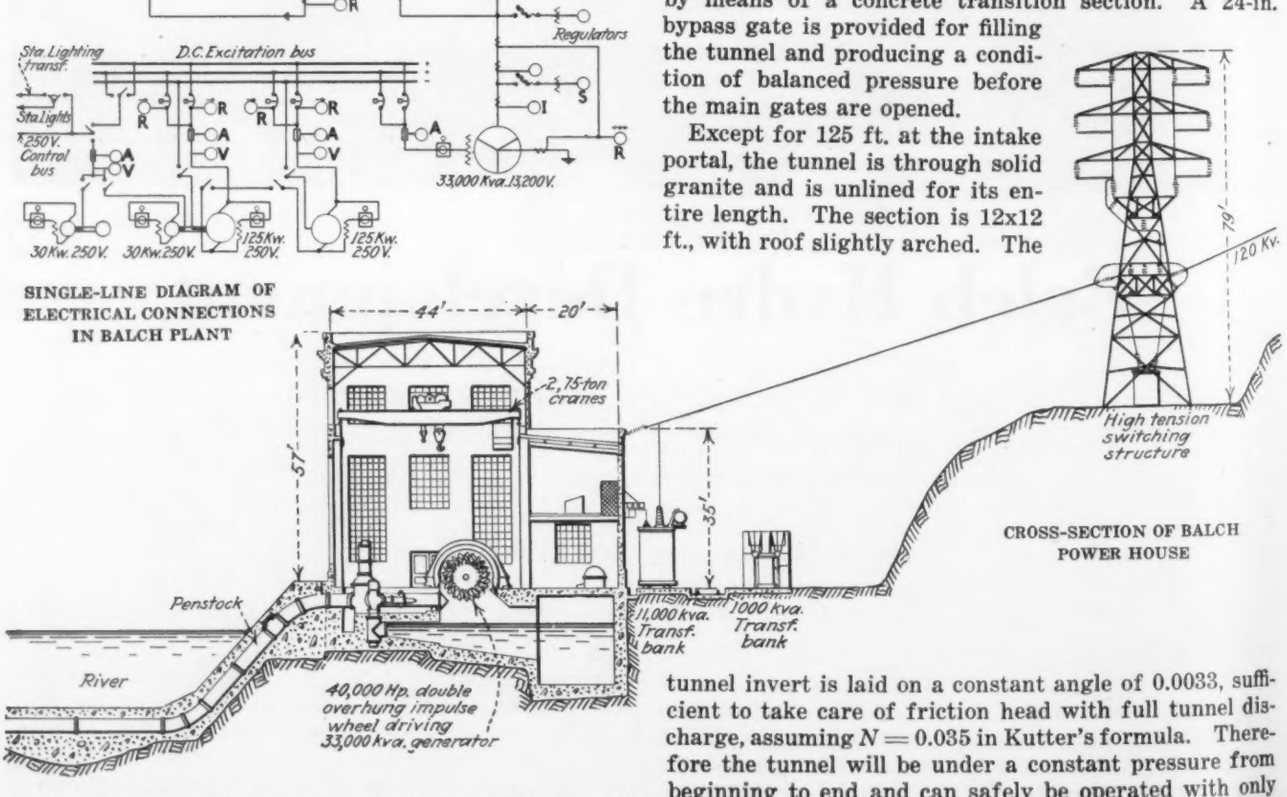
4. Adaptability of designs and details to conditions in the field, requiring close co-operation between field and office.

5. Economy of construction and operation.

The location of the plant was determined by economic factors largely influenced by physical conditions. At the present time the plant will be operated on a stream-flow basis. After storage is developed the output of the first unit will be greatly increased and it will be economical to install additional units. Therefore it was of primary importance to select a site suitable for a power house offering a good location for the pipe line and requiring a relatively short tunnel. With the location chosen it is possible to develop 1 ft. of static head for each 8.12 ft. of tunnel. The ratio of static head to length of penstock is 1 to 2.05, and the ratio of computed net head to static head is 0.942. The values are useful for comparison and are indicative of the economy of the project layout, especially with only one or two units installed. The penstock line, besides having a comparatively short slope length, has the further advantage of being steepest in the lower parts, which has the effect of decreasing the length of the heavier and more expensive pipe.



SINGLE-LINE DIAGRAM OF ELECTRICAL CONNECTIONS IN BALCH PLANT



CROSS-SECTION OF BALCH POWER HOUSE

FEATURES OF TUNNEL

Essentially the development consists of a 60-ft. concrete diversion dam, 19,348-ft. pressure tunnel, penstock with a slope length of 4,882 ft., power house and transmission line. The present diversion dam is of the constant-angle type and provides a pondage of 100 acre-ft. Later it will be raised to a height of 110 ft., providing a storage capacity of 1,200 acre-ft. The dam is equipped with two 30-in. sluice gates controlled by manually operated slide gates. Ultimately the dam will have radial gates on the crest for spillway regulation, but they are not provided in the initial section.

The tunnel intake is immediately above the dam and consists of a concrete tower, in which a 12-in. steel cylinder gate will be placed for operation after the dam is raised to its ultimate height. Concrete slide gates will be used for the present, and these will serve later as stand-by gates. The tower is connected to the tunnel by means of a concrete transition section. A 24-in. bypass gate is provided for filling the tunnel and producing a condition of balanced pressure before the main gates are opened.

Except for 125 ft. at the intake portal, the tunnel is through solid granite and is unlined for its entire length. The section is 12x12 ft., with roof slightly arched. The tunnel invert is laid on a constant angle of 0.0033, sufficient to take care of friction head with full tunnel discharge, assuming $N = 0.035$ in Kutter's formula. Therefore the tunnel will be under a constant pressure from beginning to end and can safely be operated with only sufficient head at the intake to provide for gate losses. There are two 8x12-ft. adits, each 365 ft. long. These were plugged with concrete and provided with 72-in. removable steel bulkheads and 20-in. manholes for ready access to the tunnel for inspection.

A surge shaft has been excavated in solid rock near the lower end of the tunnel. It is designed to take care of surges in the pipe line under present conditions with only one unit installed, and for the ultimate installation of four units.

BANDED STEEL PENSTOCK FOR 2,243-FT. HEAD

Because of the high operating head (2,243 ft.), the lower 2,286 ft. of the penstock is made of banded steel pipe, a type of penstock new to this country, but extensively used in foreign high-head develop-

ments. The banded pipe consists of a forge-welded steel core over which reinforcing bands are shrunk. The upper 2,596 ft. is plain welded steel pipe ranging in thickness from $\frac{3}{8}$ in. to $1\frac{5}{16}$ in. The banded section mentioned has a maximum equivalent thickness of $1\frac{3}{4}$ in. The diameter decreases in 4-in. steps from a maximum of 60 in. at the head of the line to 48 in. at a point 300 ft. above the power house. At this point the line is divided into two 34-in. branches. Pressures range from 62 lb. to 1,030 lb. per square inch. Single and double-riveted bump joints were used in the upper part of the line and riveted butt strap or band joints in the lower section and in the banded pipe. Each section of pipe was shop tested to a pressure equal to 1.65 times the working pressure in the line and the cast-steel bends were tested to twice the working pressure.

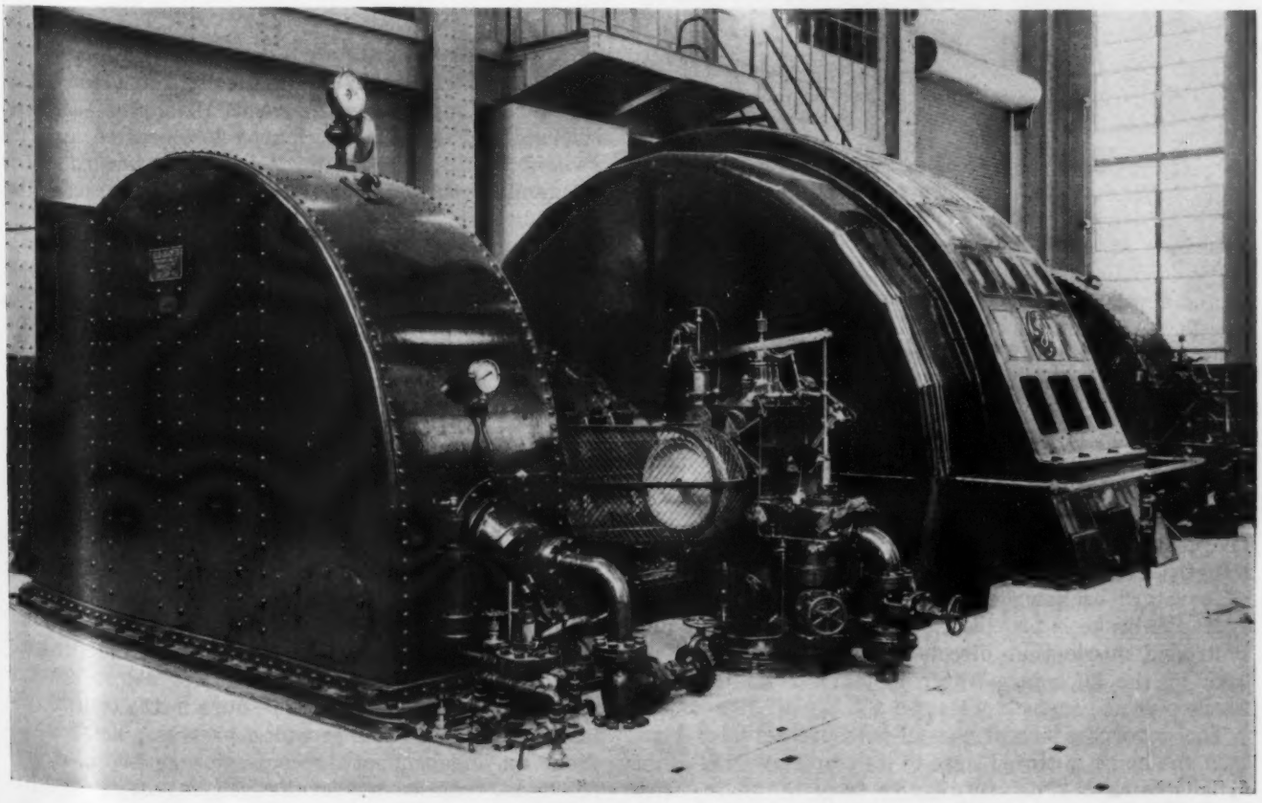
A motor-operated butterfly valve designed for remote control is provided at the head of the penstock. It may be closed from the switchboard in the power house, or it may be stopped or reversed in any position. For safety reasons it is so arranged that it cannot be opened from the switchboard from the closed position, but requires that an attendant be at the valve in order to open it. The control design permits testing out the operation of the valve from the power house, but eliminates the hazards of opening by remote control. A hand-operated bypass valve is provided for slowly filling the penstock line before the butterfly valve is opened.

The penstock is provided with a 36-in. air-inlet standpipe, three sets of 6-in. air valves, expansion joints located below bends, manholes and other appurtenances. A Venturi meter has been installed in each of the 34-in. lines at the lower end of the penstock, calibrated to indicate the discharge in second-feet and the totalized flow in acre-feet.

Owing to the steepness of the canyon, there was no room for the power house on the penstock side of the river. It was therefore placed on the opposite side, where the foundation conditions were excellent and where the power house will not be exposed to the danger of rocks rolling down the steep slopes of the canyon. This condition made it necessary to carry the penstock line across the river, and the method finally chosen was to imbed the pipe in solid concrete laid in the river bed. The concrete anchorage has been finished downstream to an ogee section to facilitate the discharge of the river past this section. Placing the pipe in the river bed was considered safer and in the long run more economical than an overhead crossing with the pipe supported in the form of an arch or on piers as a beam.

METHOD OF MOUNTING PENSTOCK ON CONCRETE PIERS TO PERMIT EASY SLIPPAGE UNDER EXPANSION AND CONTRACTION

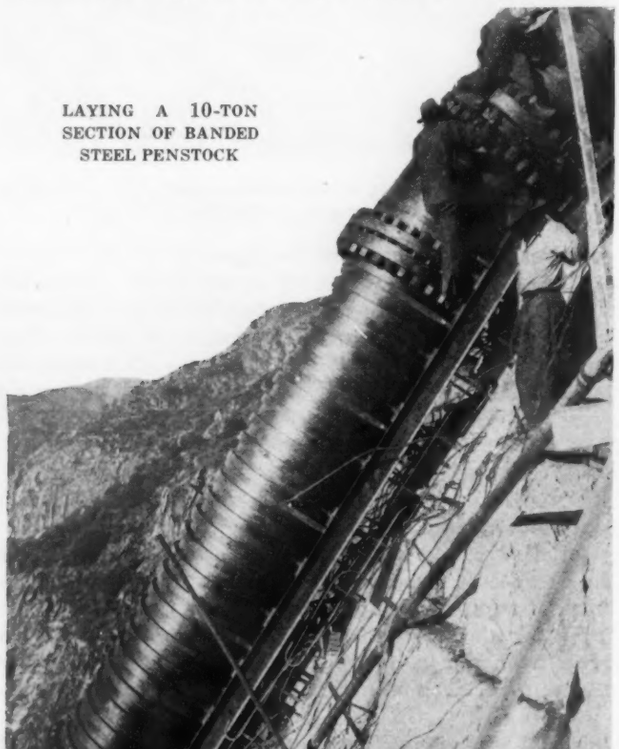
On account of locating the power house across the river from the penstock, it was necessary to construct the tailrace parallel to the river and on the opposite side



DOUBLE OVERHUNG WATERWHEELS OPERATING UNDER NET HEAD OF 2,243 FT. DRIVING 33,000-KVA. GENERATOR

of the building. The tailrace is excavated in solid rock and lined with concrete. It has a capacity of 800 sec.-ft., which is the maximum discharge of four units. Dimensions were determined by the elevation of backwater from a proposed afterbay dam below the plant, loss of head due to eight entering streams from wheel pits and the requirements of generator ventilation, air for which is taken from above the water in the tailrace.

The first unit now in operation is designed for a static head of 2,381 ft., a net head of 2,243 ft., a discharge of



LAYING A 10-TON SECTION OF BANDED STEEL PENSTOCK

180 sec.-ft., and a speed of 360 r.p.m. The unit consists of two hydraulically independent waterwheels of the overhung horizontal-shaft type, one on each end of the generator shaft. Each wheel will develop 20,000 hp., but is capable of operating with a discharge of 200 sec.-ft. and developing 22,000 hp., or 44,000 hp. total for both wheels. At a jet velocity of 370 ft. per second, or 250 miles per hour, and a bucket speed of about 120 miles per hour an impact of 61,000 lb. is exerted on each bucket.

Lubrication of parts which are in contact with the operating water (under pressure of 1,030 lb. per square inch) is obtained by means of a differential piston-type grease compressor operated from penstock pressure. The compressor is charged by means of a grease gun actuated by air at 100-lb. pressure.

To retard each wheel when the water is shut off a hydraulic brake is provided, consisting of a small hand-controlled nozzle that directs a water jet against the back of the buckets. Water is taken from the main nozzle pipe at penstock pressure.

The governors are of the oil-pressure actuator type, each one being mounted close to its respective wheel, the flyballs being belt driven directly from the main shaft. The flyballs are of the balanced spring precision type,

DATA ON PRINCIPAL HYDRAULIC AND ELECTRICAL EQUIPMENT OF THE BALCH POWER PROJECT

Equipment	Manufacturer
One 60-in. motor-operated, remote-controlled, cast-steel butterfly valve	Pelton Water Wheel Company
Penstock	Ferrum Company, Poland
Three sets of 6-in. air valves	Simplex — Water Works Supply Company
Two Venturi meters and recorders.	
Two 32-in. gate valves, 1,500 lb. working pressure and hydraulic cylinder operation	Joshua Hendy Iron Works
Exciter penstock pipe, 10 in. and 6 in., and miscellaneous valves and fittings, 2,000 lb.	Crane Company
Impulse waterwheels	Allis-Chalmers Manufacturing Company
One 40,000-hp., double overhung	
One 200-hp., single overhung	
One 250-hp., single overhung	
Governor oil-pressure system	
Two governors for 40,000-hp. waterwheel	
Two governors for 200 and 250-hp. waterwheels	Woodward
Generators:	General Electric Company
One 33,000-kva., 13,200-volt	
Two 125-kw., 250-volt	
One 30-kw., 250-volt	
One motor-generator set, 30-kw., 250-volt	
Two 2,000-amp., 1,500-volt, motor-operated disconnecting switches	Electric Power & Equipment Company
One 500-amp., 15,000-volt, motor-operated disconnecting switch	
One 400-amp., 132-kv., six-break oil circuit breaker	Kelman Manufacturing Company
Two 400-amp., 132-kv., single-break disconnecting switches	Delta-Star Company
One 400-amp., 132-kv., double-break disconnecting switch	
Two 2,000-amp., 15,000-volt, type F H 206 oil breakers	General Electric Company
One 500-amp., 15,000-volt type F H 206 oil breaker	
Three 600-amp., 15,000-volt type F K 32 C oil breakers	
Four 11,000-kva. transformers, 13,200/-132,000 volts	
Four 1,000-kva. transformers, 13,200/-11,500 volts	
Three five-panel switchboards complete	
Lightning arrester, 15,000 volts	
Two 75-ton cranes	Cyclops Iron Works
Structural steel for 132-kv. bus structure	Pacific Coast Steel Company

completely incased and automatically lubricated. Each governor is equipped with synchronizing, load-limit and solenoid-trip devices, which may be operated from the switchboard. Rate-limit device and governor trip actuated by belt failure are not controlled from the switchboard.

As the governors are designed to shut off the water in a few seconds, thus tending to induce excessive pressure rises in the penstock, regulators having full discharge capacity are provided, one for each wheel nozzle. The regulators are so connected to the governors that when the latter close the needles rapidly, the regulators open synchronously and discharge the water into the wheel pits, so that no appreciable velocity change occurs in the penstock. The pressure regulators are provided with a dashpot arrangement, causing them to close at a predetermined rate to reduce the wastage of water.

Provisions have been made in the designs so that the pressure regulators are responsive to rises of pressure that might occur from the sudden stopping of flow due to lodgment of some obstruction in the nozzle throat. In this case the regulators would function independently of governor action. The pressure regulators are pressure operated. The supply pressure to the control valve is not obtained from penstock pressure, however, but from an independent pressure source supplied by a 3,000-gal. tank located on the hillside. A motor-driven air compressor, having a capacity of 17 cu.ft. per

minute, is used to keep the oil pressure tank constantly charged with air at 150-lb. pressure.

Installed in the penstock for each waterwheel is a 32-in. hydraulic-operated gate valve, designed for a pressure of 1,500 lb. per square inch. The valves are located in the power house building in order that they may be handled by the crane. A balanced needle-type manually operated bypass valve is provided for each gate valve. The hydraulic cylinders are operated at penstock pressure by means of a slide valve, which may be closed from the switchboard.

ELECTRICAL EQUIPMENT

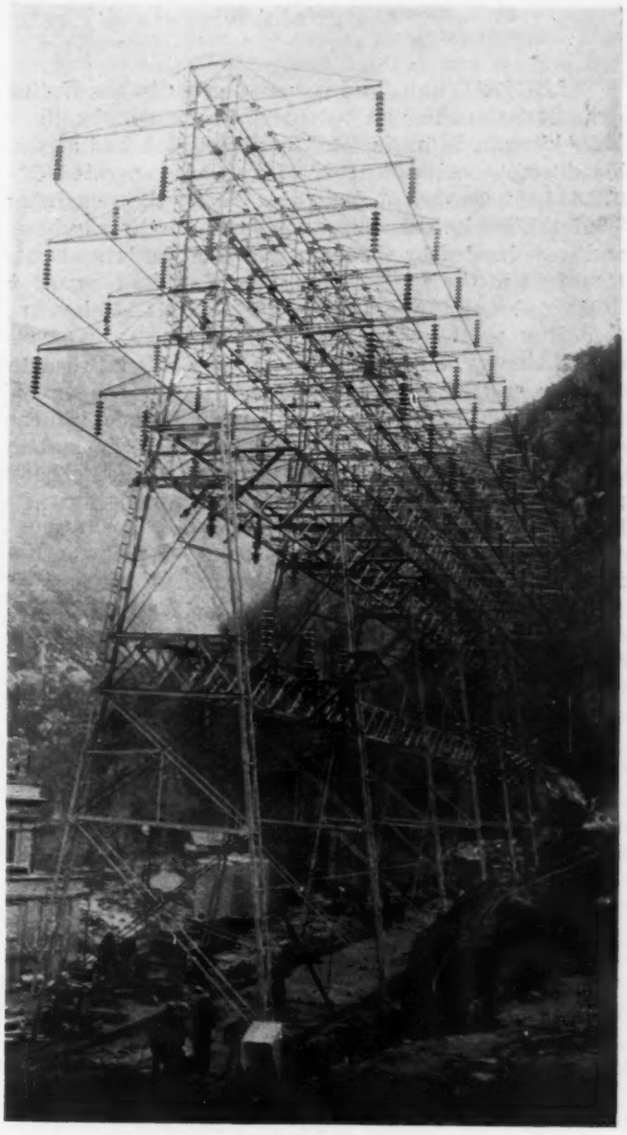
The plant contains one 33,000-kva., 360-r.p.m., 13,200-volt, three-phase, 60-cycle, grounded neutral, horizontal type generator, mounted between the two main bearings. Air for cooling the generator is drawn off the tailrace and is discharged outside the building through two concrete tunnels below the nozzle-pit floor. Eliminators are provided to remove all free or unabsorbed moisture and solid matter before it reaches the generator.

Two 125-kw., 250-volt exciters, each of sufficient capacity to excite the main generator, are provided. Once is driven by a 200-hp., single-jet, single-overhung impulse waterwheel, the other by a 250-hp. wheel. The latter unit has a 30-kw., 250-volt, direct-current generator, direct connected to the exciter. Each waterwheel is controlled by an oil-pressure governor. Oil is taken from the pressure system of the main unit. The relative merits of direct-connected and separately driven exciters were investigated and after consideration of operating difficulties, due to deflection of generator shaft, first cost of a 360-r.p.m. over a 900-r.p.m generator, 8-ft. saving in length of building and flexibility of operation, the separately driven exciters were installed.

Power for operation of circuit breakers and auxiliary apparatus is furnished either by the 30-kw. motor-generator set or the 30-kw. generator driven by the exciter waterwheel. The possibility of the penstock being empty and outside source of power being cut off at the same time was considered so remote that storage batteries were not installed, except for telephone and alarm circuits. Local power is taken directly off the main generator bus through a truck-type oil circuit breaker to a bank of three 1,000-kva. transformers, which are used as reactors for protecting the bus. Station power is distributed from an auxiliary switchboard by means of back-of-board type knife switches.

Two motor-driven, sectionalizing, gang-operated disconnecting switches, having a capacity of 2,000 amp. each, are provided in the generator bus. These are controlled from the switchboard, and the control wiring is so interlocked with the 2,000-amp. oil circuit breakers that the disconnecting switches cannot be operated while the bus is energized. A motor-operated three-pole bypass disconnecting switch is provided for the 500-amp. oil circuit breakers. This switch cannot be operated when the breaker is open.

Three 11,000-kva., oil-filled, water-cooled transformers step the voltage up to 132,000 volts for transmission. These tie into the 132-kv. bus through a 400-amp. oil circuit breaker with bushing type current transformers. This circuit breaker is also used as a line switch with the present installation. The breaker is sectionalized by 400-amp., single-break, gang-operated disconnecting switches. One 400-amp., double-break, gang-operated, three-pole disconnecting switch bypasses the 132-kv. oil breaker. Space is provided in the present 132-kv. outdoor bus structure for four outgoing lines and one transformer breaker. The ultimate structure will have a double bus with all breakers in line and space for two incoming lines, four transformer breakers, four outgoing lines and one transfer breaker.



132-KV. BUS STRUCTURE AT BALCH PLANT

Differential relay protection is provided for the generator and the 11,000-kva. transformers, overcurrent relays for the 600-amp. truck type circuit breakers and power directional relays for transformer protection. The 11,000-kva. transformers are equipped with ratio adjusters, capillary tube thermometers with alarm contacts and temperature-indicating coils. The 1,000-kva. transformers omit the temperature-indicating coils.

Operators' quarters are located at Balch camp about two miles distant from the power house. Seven cottages of Class A construction with a garage have been provided. The houses are of hollow tile and stucco construction with Spanish tile roofs and are equipped with electric ranges and electric hot-water heaters.

The project was designed and constructed by the San Joaquin Light & Power Corporation under the direction of Harold K. Fox, superintendent of construction.

Hundred-Million-Kilowatt-Hour Utilities

United States Has 126 Systems Each with an Output Greater than 100,000,000 Kw.-Hr.—Energy Produced Represents 84.5 Per Cent of Country's Total Generation—Buffalo, Niagara & Eastern Power Corporation Leads

ELECTRIC light and power systems in the United States having an output of one hundred million kilowatt-hours in 1926 numbered 126, had a combined output of 66,981,107,967 kw.-hr., generated 58,073,674,401 kw.-hr. in their own plants, the remaining 8,907,433,566 kw.-hr. being accounted for by purchase, and were headed by the system having the largest output of all in the world, that of the Buffalo, Niagara & Eastern Power Corporation, with 4,463,911,125 kw.-hr., according to the results of the ELECTRICAL WORLD'S annual survey of major power systems. Detailed data on these systems are presented in a supplement accompanying this issue; the compilations include returns also from ten Canadian systems, one Mexican system and fifteen electric railways, making altogether 152 public utility systems in the hundred-million-kilowatt-hour class. The corresponding tabulation for 1925 included 110 light and power systems in the United States, seven in Canada and twelve railways, a total of 129. The change from 110 in 1925 to 126 in 1926 indicates a net gain in the first-named group of sixteen systems. The actual increase was greater. There are thirty new names; consolidations and realignments have caused the disappearance of fourteen of those on the old list, though the same physical operations are again included, but under fewer names. The rest of the increase is accounted for by the formation of new systems out of constituent companies too small for inclusion in this list, and by the normal growth of systems that were almost eligible last year.

INCLUDES 84.5 PER CENT OF TOTAL ENERGY

In 1925 the energy generated by the 110 systems was 81 per cent of the national total for the industry; in 1926 the 126 systems generated 84.5 per cent of the national total, and their entire output, including purchased energy, missed that total by only 3 per cent.

Eighteen systems each had an output of more than a billion kilowatt-hours in 1926; in 1925 there were fourteen. The Niagara Falls Power Company's system has been replaced at the head of the list by that of the Buffalo, Niagara & Eastern Power Corporation, of which it now forms a part. The four new accessions are the North American Company's California system, the Mohawk-Hudson, the Cleveland Electric Illuminating Company and the Ohio Power Company systems. The combined outputs of these eighteen were slightly over 33,900,000,000 kw.-hr., of which 30,100,000,000, or 43.5 per cent of the national total, was generated in their own plants. By adding the next seven it is found that the first twenty-five companies, arranged in order of output, generated 35,400,000,000 kw.-hr., or slightly more than half the total for the United States.

LARGE INCREASES NOTED

Second place for output in the United States again goes to the Commonwealth Edison Company of Chicago, with 3,482,632,000 kw.-hr., all but 3.6 per cent of it generated in its own plants. This is 10 per cent above the leader for 1925 and 12.6 per cent above the company's own 1925 record—conspicuous evidence of the rapid increase in the use of electrical energy. The Edison-United Companies of New York were again third, and the next two places went to California. Second place, regardless of national boundaries, however, goes to the Hydro-Electric Power Commission of Ontario, with 3,867,398,041 kw.-hr., all but 5 per cent generated in its own plants. Two other Canadian companies have passed the billion-kilowatt-hour mark—the Shawinigan Water & Power Company, with 2,557,613,443 kw.-hr., and the Montreal Light, Heat & Power Consolidated, with 1,251,502,612 kw.-hr. The same three Canadian companies were in the billion group in 1925. The highest peak was reported by the Commonwealth Edison Company—897,000 kw. (instantaneous) on Dec. 15; next was the Edison-United Companies' peak of 731,694 kw. (instantaneous) on Dec. 20. Notwithstanding its greater output, the Buffalo, Niagara & Eastern reported a smaller peak, namely, 682,800 kw.

The accompanying tables summarize the detailed data contained in the supplement. The 126 companies reported a total of 1,248 generating plants, with a combined rating of 23,059,063 kva.

Though the fuel-burning plants contain 69 per cent of the rated installation, they constitute not much more than half the total number, 54.5 per cent. They are, on the average, considerably larger than the hydro plants—23,400 kva. against 12,600 kva. The steam sta-

TABLE I—GENERATOR RATING AND OUTPUT OF COMPANIES REPORTING AN OUTPUT OF OVER 100,000,000 KW.-HR. DURING 1926
(Summary of detailed tabulation issued as supplement to this issue of the ELECTRICAL WORLD)

Section	Number of Companies or Systems Reporting Over 100,000,000 Kw.-Hr.		Generating Plants and Generator Rating — Total		Fuel Burning Plants		Hydro-Electric Plants		Energy Generated	Energy Purchased	Highest Peak Loads, Kw. Reported (Instantaneous)	
	1926	1925	No.	Rating, Kva.	No.	Rating, Kva.	No.	Rating, Kva.	Kw.-Hr. 1926	Kw.-Hr. 1926	1926	1925
United States	126*	110	1,248	23,059,063	679	15,895,360	569	7,163,703	58,073,674,401	8,907,433,566	897,000	809,000
New England	14*	10	68	1,501,622	21	1,157,117	47	344,505	3,057,651,662	548,771,024	190,276	203,199
Middle Atlantic	22	23	173	6,861,600	92	5,040,271	81	1,821,329	17,255,212,662	2,449,111,356	731,694	656,312
South Atlantic	10	12	153	2,058,090	82	1,271,812	71	786,278	4,438,394,021	721,201,039	205,000	291,000
East North Central	30	22	278	5,347,963	166	5,004,244	112	343,719	13,868,025,685	2,425,344,643	897,000	809,000
West North Central	8	10	96	1,478,618	54	1,074,818	42	403,800	3,548,746,244	83,796,670	278,121	258,626
East South Central	9	6	103	1,559,128	72	691,323	31	867,805	3,217,084,728	910,092,530	420,000†	291,000
West South Central	9	6	124	527,750	118	516,000	6	11,750	1,345,657,640	318,537,710	76,300	57,830
Mountain	6	4	82	732,135	18	175,575	64	556,560	2,840,776,948	90,114,636	188,400	172,600
Pacific	18	17	171	2,992,157	56	964,200	115	2,027,957	8,502,124,811	1,360,463,958	422,700	395,900

*Including two companies covered by footnotes in Tables I and II of supplement. †Peak loads reported over five-minute period.

TABLE II—ENERGY DISTRIBUTION OF COMPANIES REPORTING AN OUTPUT OF OVER 100,000,000 KW.-HR. DURING 1926

Section	Energy Distribution to Light and Power Customers, 1926 (per Cent): Domestic Customers	Commercial Customers	Power Customers (Not Including Railways)	Energy Sold to Electric Railways, Kw.-Hr.	Total Number of Customers (All Classes)
United States	12.3	16.1	71.6	4,413,561,749	13,991,880
New England	10.2	10.8	79.0	133,254,573	568,211
Middle Atlantic	12.0	18.3	69.7	1,678,505,668	4,894,735
South Atlantic	11.2	16.6	72.2	24,538,579	685,214
East North Central	14.2	15.3	70.5	1,541,408,325	3,675,075
West North Central	12.3	19.0	68.7	41,153,516	939,654
East South Central	9.6	17.0	73.4	58,634,358	562,095
West South Central	11.3	19.1	69.6	87,534,766	394,849
Mountain	6.3	6.7	87.0	187,080,954	324,079
Pacific	14.9	20.1	65.0	661,451,010	1,947,968

tions in the densely populated industrial sections primarily dependent on fuel—though water power is not lacking—are notably larger, on the whole, than those in other sections of the country. The influence of the huge modern stations is here quite obvious. Thus the average for New England is, in round numbers, 55,000, for the Middle Atlantic States 55,000, and for the East North Central 30,000 kva.

Interconnection Used Freely

The extent to which interconnection is serving to make interchanges and intercompany sales possible appears from the relatively high figures for purchased energy. These great systems are first of all generating systems. Large sales to smaller utilities, not blessed with the most efficient plants, are to be expected. Evidently, though, even in these great systems economies can be effected by purchase or interchange of energy, otherwise they would not buy 13.3 per cent of their whole output.

For the table headed "Comparative Operating Conditions" certain ratios have been worked out for a number of the larger systems. Beginning with the largest, twenty companies were selected whose systems were predominantly transmission systems, and twenty others that were essentially metropolitan. The two classes merge, and in practice a sharp distinction cannot in all cases be drawn; the inferences from the data must therefore be partly qualitative. The figures in each column of the table have been arranged in order of magnitude, and not according to companies. Further, the columns are independent; figures on the same line have no necessary connection.

The first two columns bring out the wide variation in plant factor, defined as the ratio of the average load to the plant rating.

TABLE III—COMPARATIVE OPERATING CONDITIONS

Plant Factors		Load Factors		Line Losses		Plant Factors		Load Factors		Line Losses	
Transmission	Metropolitan	Transmission	Metropolitan	Transmission	Metropolitan	Transmission	Metropolitan	Transmission	Metropolitan	Transmission	Metropolitan
81.5	73.1	84.2	57.0	30.6	23.5	49.3	42.9	56.0	45.8	15.5	14.4
71.5	63.6	76.2	56.2	28.1	20.6	45.5	37.6	55.3	45.4	15.3	13.7
63.8	59.6	75.3	54.9	26.8	18.9	43.5	36.6	53.3	44.4	13.9	13.1
57.1	50.2	74.7	53.9	20.3	18.2	41.6	36.1	52.5	43.6	13.6	11.2
55.3	48.1	62.1	53.7	20.1	17.1	37.6	35.7	52.0	41.5	13.2	10.9
54.6	48.0	60.6	53.1	18.7	16.7	36.5	33.4	51.1	41.3	12.0	9.5
53.5	47.6	60.5	52.5	18.2	16.5	33.6	29.5	50.3	40.4	11.7	8.7
53.2	46.7	60.2	52.0	16.8	15.9	32.1	24.5	48.9	40.3	9.6	8.6
51.8	46.0	60.0	49.5	16.3	15.4	24.9	24.4	48.4	38.3	9.3	7.1
51.5	43.0	58.9	45.9	15.9	14.7	17.4	32.2	44.2	36.3	8.05	6.1

The transmission companies here rank distinctly higher than the metropolitan. The reason is that energy is purchased and there is a greater diversity in load in a system covering a large territory and interconnected with other systems. A marked variation occurs in system operating conditions so that any attempt at averaging load and plant factors leads to meaningless figures. A comparison of data on systems covering the past few years, however, shows a steady improvement in plant and load factors on the larger systems.

An off-hand comparison of line losses shows that they have not been changed during the past year. Metropolitan systems have slightly lower figures than the transmission systems, as would be expected, but the difference is not marked despite the rapid increase in transmission lines made during 1926. Losses of about 15 per cent offer an opportunity for some operating economies which would justify quite large investments.

Historical Review of Canadian Water Power from 1895 to Date

A COMPREHENSIVE survey of the early history and recent progress of water-power development in Canada has just been issued by the Water Power Branch of the Department of the Interior at Ottawa. By the end of the year 1906 the total turbine installation in Canada had passed 600,000 hp. and in that year alone 150,000 hp. was put into service. From that time on there has been a rapid increase in the turbine installations. New enterprises were, of course, curtailed during the Great War, but soon after its close they were resumed, and in the last four years more than a million and a half horsepower has been installed, bringing the total on Dec. 31, 1926, to 4,556,000 hp.

In round numbers, the known available water power in Canada is 18,255,000 hp. under conditions of ordinary minimum flow and 32,076,000 hp. available under condition of ordinary six months' flow. The installed turbine horsepower includes plants for utilizing water at times of high flow, as well as reserve plants. Thus, Canada's total available power, reckoned on the same basis, would probably correspond to nearly 42,000,000 hp.—so that only about 11 per cent of the recorded resources are so far utilized. During the past ten years the developed water power has increased at an annual average rate of over 7½ per cent. This, however, includes the portion of the war and post-war period when many projects were in abeyance. During 1925 the increase was over 20 per cent, and the annual average for the last three years is nearly 13 per cent.

In Ontario 395,000 hp. of new installation has been added during the past three years. Of this 220,000 hp. is in the Queenston plant and 25,000 hp. in the Nipigon plant of the Hydro-Electric Power Commission. Privately owned enterprises included 48,000 hp. on the Abitibi River and 17,000 hp. at the outlet of the Lake of the Woods for pulp and paper manufacture. New developments under construction are those of the Spruce Falls Company at Smoky Falls, on the Mattagami River, of 70,000 hp. and the 37,620-hp. development of the Backus-Brooks company on the Seine River. More than 780,000 hp. was developed in Quebec during the same period. This huge total included 20,000 hp. on the Quinze River for mining, 220,000 hp. for general distribution on the St. Maurice, St. Francis, Batiscan,

Ottawa and St. Lawrence Rivers, and a mammoth development on the Saguenay River by the Quebec Development Company. On the latter project 450,000 hp. of an ultimate 540,000 hp. installation was completed for pulp and paper and other purposes at an estimated expenditure of $35,000,000.

A large amount of construction work is now in hand and still more is in view. It is estimated that 400,000 hp. will be completed this year, and additional work, which is practically assured, will aggregate 1,900,000 hp. in the following three or four years. This figure excludes probable new development on the St. Lawrence, Ottawa and Niagara Rivers, which cannot yet be said to be actually assured.

Letters from Our Readers

Fault Found with Copper and Brass Research Association's Survey

To the Editor of the ELECTRICAL WORLD:

In the ELECTRICAL WORLD of March 12 there is an article on page 571 headed "Independent Study of Rates" which contains a tabulated statement of the results of a survey. Because of the figures used it is not apparent what is the meaning of the caption "Average Monthly Bill 30 Kw.-Hr." Applying the obvious interpretation, that the figures under this caption represent the average residence bill at current rates, assuming 30 kw.-hr. per month consumption, the figures given for the District of Columbia are not correct, showing as they do an average rate of 13 cents per kilowatt-hour, which is a considerably higher rate than has been in existence in the District of Columbia for about twenty years. Our maximum billing rate in 1921 was 10 cents per kilowatt-hour and the rate at the present time is 6.25 cents per kilowatt-hour, a reduction of 37½ per cent instead of 25 per cent as shown in the tabulation.

Without attempting to check other figures given in this article, it is believed that at least some of them are incorrect, showing as they do average rates in many cases in excess of 10 cents per kilowatt-hour.

H. A. BROOKS,
Commercial Manager.

[The figures, as stated in the article, which formed no part of the ELECTRICAL WORLD'S statistical service, are those of the Copper and Brass Research Association. It is probable that the average monthly consumption used in some cases exceeded the 30 kw.-hr. apparently assumed.—EDITOR.]

Standardization and the Institute

To the Editor of the ELECTRICAL WORLD:

I feel that I must congratulate the ELECTRICAL WORLD on the editorial appearing in the March 26 issue under the title "Order and Authority Needed in Standardization." What you say accurately presents the viewpoint that I have held for the last six years, and, as is usual with you, the facts are singularly well stated. It may well be that your presentment will prove the turning point in the situation. It surely is a milestone.

No one has greater admiration for the work of the Institute than have I, nor, I believe, has any one a keener appreciation of the gratitude owing for the work done and the foundation laid. It is the fact, however, that, although undoubtedly the most representative single body, the Institute still is not truly representative of the whole body, and the body as a whole can alone develop those standards which will insure the maximum of acceptance.

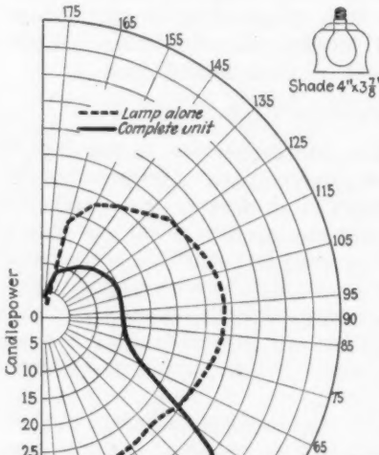
A. W. BERRESFORD.
Electric Refrigeration Corporation,
Detroit, Mich.

Shaded Light—A Satisfaction to Customer as Well as to Utility

To the Editor of the ELECTRICAL WORLD:

Infrequently, but often enough to cast aspersions on the good motives of central-station companies, glass manufacturers and lamp manufacturers, these groups have been charged with joining forces to advocate the shading of lamps, primarily because the shades absorb light and hence more lamps are required to produce a given result in illumination. Any implication that proper shading is being recommended purely for mercenary reasons is resented.

It is perfectly true that where people have pleasantly shaded light they will like it better and therefore be likely to use it for longer hours than where pushing a switch simply brings before the eye a garish display



Angle	Candle-power	Zone	Lumens
0	51		
5	50	0-10	5
15	52	0-20	19
25	53	0-30	44
35	55	0-40	78
45	50	0-50	115
55	34	0-60	146
65	21	0-70	167
75	17	0-80	185
85	15	0-90	201
90	15		
95	15	0-100	218
105	15	0-110	234
115	15	0-120	249
125	14	0-130	261
135	13	0-140	271
145	12	0-150	279
155	10	0-160	283
165	9	0-170	285
175	4	0-180	286

LIGHT DISTRIBUTION CURVES OF BOTH BARE AND SHADED LAMPS

Zone	Lumens	Per Cent Total Clear Lamp
0-60		36.4
0-90		50.3
90-180		21.3
0-180		71.6

of lamp bulbs. It is also true that where lamps are shaded one can have as much illumination and use as large lamps as he may wish without discomfort, whereas bare lamps, because of their glare, halt the consumer at a point where the illumination in the room is less than he would really like to have.

Of course, any shade will absorb a certain number of rays, but if properly designed it will redirect the bulk of the light in such a way as actually to give better illumination for a given expenditure of power than could be obtained without it. The accompanying distribution curves of a bare lamp and the same lamp equipped with a typical residence shade serve to illustrate this point.

In a word, the selfish interest of the electrical industry in advocating shaded light is that people will like it better, will therefore use more of it and will use it for more hours. It will prove profitable to us because it serves the customer best.

WARD HARRISON,
Director Illuminating Engineering.
National Lamp Works of General Electric Company,
Nela Park, Cleveland, Ohio.

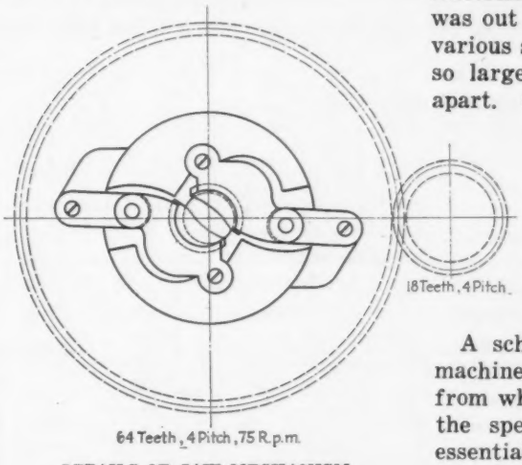
Central Station and Industrial Practice

Salvaging Iron Cross-Arm Pins by Machinery

By J. M. Stuart
General Storekeeper Narragansett Electric Lighting Company, Providence, R. I.

FOR many years the Narragansett Electric Lighting Company has used malleable-iron cross-arm pins with a $\frac{7}{8}$-in. lag screw on one end and, at the other end, a head threaded to take the standard insulators. Formerly pins were removed by hand wrenches, but as a result of a design by A. R. Beverly, of this company, this work is now done by the equipment illustrated herewith. In installing cross-arms, $\frac{13}{16}$-in. holes are bored $2\frac{1}{2}$ in. deep in the arms. The pins are first dipped in paint and then screwed into the holes, the paint acting as a lubricant while the pins are being inserted and sealing them well into the arms. Originally pins were turned in by hand wrench, but for the past ten years a reversible electric drill equipped with a special chuck has been used to save labor.

About three years ago the company experienced such a severe storm that from March until the middle of July two men were kept busy daily in removing screw-type insulator pins from the old cross-arms by the use of Stillson wrenches operated by hand. The machine shown herewith now does all this work. It consists essentially of a set of Stillson-type jaws mounted on a shaft and driven through suitable gearing and belting by a 1-hp. motor. A flywheel and clutch are provided to stabilize operations and enable the pins to be inserted and withdrawn without stopping the motor. For safety reasons the revolving jaws are covered with an iron plate, leaving a hole for the insertion of the pin. Various points of mechanical



DETAILS OF JAW MECHANISM OF POWER WRENCH

slippage are provided for to take up the strain of starting a pin well rusted into the arm. After the pin has been unscrewed from the arm, a slight turn of the hand wheel to the left drops the pin into a keg below the machine.

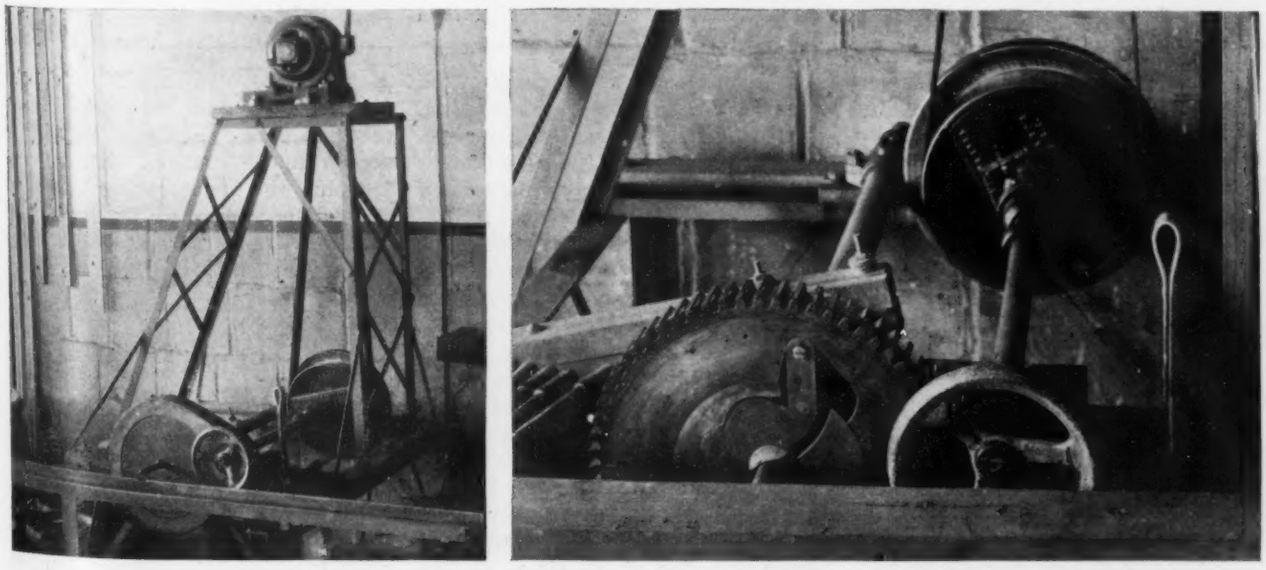
Tandem Drive-Control in a Textile Plant

By R. T. Kintzing
Control Engineering Department, Westinghouse Electric & Manufacturing Company

AN EASTERN textile plant recently installed a tandem or train drive for a process involving continuous printing of patterns on rugs, setting the dyes and drying the material. Straight mechanical drive was out of the question, because the various sections of the machine were so large and were located too far apart. Consequently it was decided to operate the individual sections with electric motors regulated to maintain synchronous speed relation between sections just as accurately as if a straight mechanical drive had been used.

A schematic arrangement of the machine and motor drives is shown from which it may be observed that the speed-regulating equipment is essentially an automatic field rheostat controlling the field strength of the motors. The master regulator driven by the printer section controls the speed of the steamer motor, whereas the master section driven by the steamer controls the speed of the first drier, etc.

In previous trains for textile and other industrial machinery, when it



ASSEMBLY OF POWER-DRIVEN WRENCH WITH SAFETY COVER AND JAW MECHANISM WITH PIN INSERTED AND GUARD REMOVED

was necessary to pass material continuously through several machines in tandem it was the practice to utilize the slack material between sections to control the driving motor speeds. When the amount of slack decreased, an idler roll operated by the slack material moved a rheostat or similar mechanism properly to adjust the speed. The reverse action occurred when the amount of slack increased.

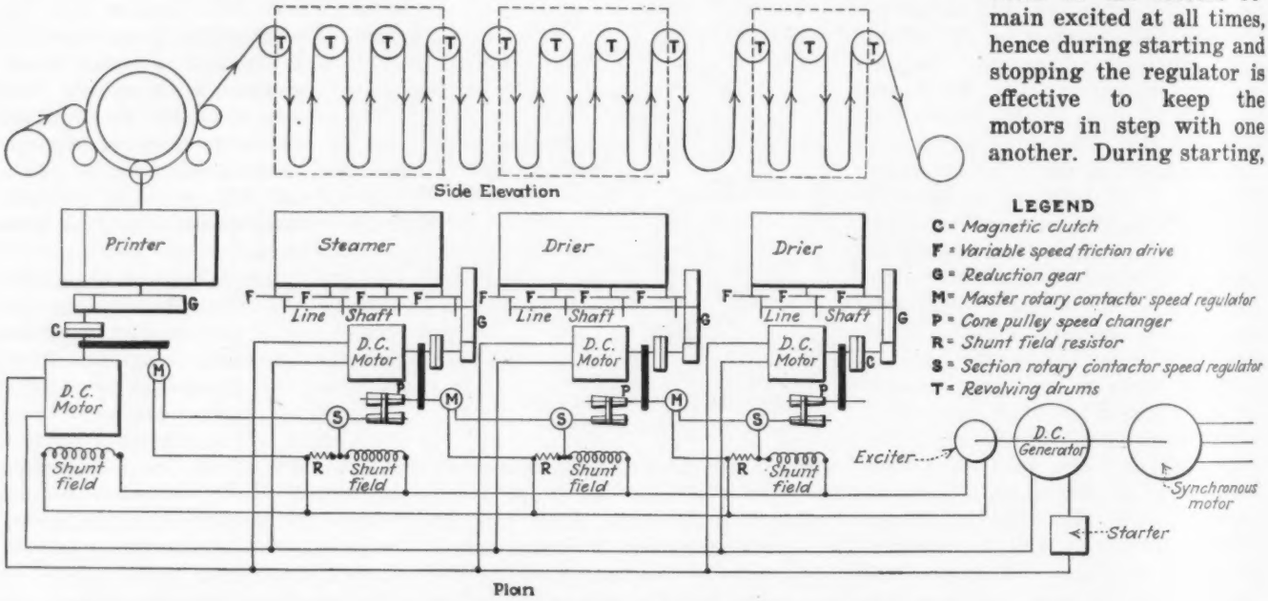
In the present case this type of control could not be used, because of the nature of the material. The material had to be handled while the dyes were still wet and for that reason could not be touched except on the reverse side. Furthermore, the tions must be started and stopped without disturbing the operation of the train as a whole.

Wide speed range necessitates the use of direct-current motors. Power is obtained from a synchronous motor-generator set at 80 to 250 volts direct current. The various sections are connected permanently in parallel and started by connecting them to the generator at low voltage and then raising the voltage by means of a motor-operated rheostat until the desired speed is reached. Sections of the machine are connected to the motors by means of magnetic clutches. When it is desired to start the entire train the clutches are engaged before the motors are started, but when certain sections must be started and stopped while others are running, local control of the clutches is used.

If it were not for the requirement that the speed of the various section motors must be adjustable with respect to one another, synchronous motors could be used. The control speed regulating system, however, locks the direct-current section motors together, so that their action is similar to that of synchronous motors, but at the same time their speeds are adjustable with respect to one another. The speed can be changed only by shifting the belt on the small section speed changer, since the rotor of the section rotary contactor operates at all times at the same speed as the rotor of the master rotary contactor.

A modification of the speed regulator developed for paper machine control is applied to the section motors in order to synchronize them and maintain control of the length of material between sections. This control consists of a number of field resistors, short circuited periodically by rotating drum segments. The effect is similar to that produced by the well-known vibrating voltage regulator. By this means very accurate control of the motor speeds is obtained and it is easy to adjust the speed when necessary.

The speed regulator is effective not only during the normal operation of the machines but also during the starting and stopping periods. The fields of the motors remain excited at all times, hence during starting and stopping the regulator is effective to keep the motors in step with one another. During starting, the regulator manipulates the motor field strengths so that the motors take the correct share of current to accelerate in unison, and during stopping the regenerating action of the motors, assisted by the speed regulator, tends to keep the motors in step until they stop.



SCHEMATIC DIAGRAM OF TANDEM MOTOR CONTROL FOR TEXTILE PLANT

This particular train of machinery consists of a printer, steamer and two driers. The steamer and driers are equipped with a number of revolving rolls over which the material passes in loops or festoons. In the latter respect the machines differ from those ordinarily used in which the loops of material are carried on rods that move from one end of the machine to the other.

length of material changes considerably during the process, stretching and shrinking during the operations of steaming and drying. The amount of stretch and shrinkage changes with the different weights of material. It was therefore necessary to introduce an adjustable control for the section motors, independent of the slack material between sections.

On account of the stretch and shrinkage of the material during the process, individual mechanical speed adjustment of the various rolls was necessary. This was accomplished by means of a variable speed friction drive from a common line shaft.

Ordinarily the entire train of machines must be controlled from the printer section, but occasionally sec-

Economic Size of Transformers

WHEN a transformer is to be installed to serve rapidly growing demands, the question usually arises whether a relatively small transformer should be erected and later replaced by a larger unit or whether the latter should be installed initially. As a guide to the solution

BASIS FOR DETERMINING ECONOMICAL SIZE OF TRANSFORMER TO INSTALL

The figures in the rectangles running diagonally across the table give cost of transformers installed as the top value and yearly cost of operation of transformers as the lower value. The figures to the right and above the diagonal give the difference between the installed costs of transformers as the top value and the difference between yearly operating costs of the two sizes, each operating at a load that is equal to the normal load on the smaller unit, as the lower value. The figures to the left and below the diagonal give the cost of changing from a smaller transformer size to a larger as the top value and the number of months it is economical to operate the smaller transformer before changing to a larger transformer as the lower value.

Kva.	1½	3	5	7½	10	15	25	37½	50
1½	69.00 23.60	17.00 5.47	56.00 13.05	77.00 22.30	101.00 30.36	139.00 46.72	214.00 77.30	307.00 110.88	378.00 131.30
3	12.00 26	86.00 33.15	39.00 5.95	60.00 14.25	84.00 21.90	122.00 38.12	197.00 68.22	290.00 101.55	361.00 121.92
5	18.80 17	18.80 38	125.00 44.80	21.00 6.18	45.00 12.80	83.00 27.93	158.00 57.40	251.00 90.45	322.00 110.66
7½	19.55 10.5	19.55 16.5	12.00 23	146.00 57.95	24.00 4.65	62.00 17.81	137.00 45.87	230.00 78.35	301.00 98.27
10	21.55 8.5	21.55 12	14.75 14	14.00 36	170.00 69.60	38.00 10.40	113.00 36.48	206.00 68.18	277.00 87.95
15	21.55 5.5	21.55 7	14.75 6.5	14.00 9	14.00 16	208.00 92.15	75.00 20.35	168.00 49.85	239.00 68.25
25	24.55 3.8	24.55 4.3	17.75 3.7	17.00 4.5	17.00 5.6	17.00 10	283.00 133.30	93.00 22.10	164.00 36.80
37½	37.00 4	37.00 4.4	30.70 3.9	30.70 4.7	30.70 5.4	30.70 7.4	29.70 16	376.00 181.80	71.00 7.35
50	38.50 3.5	38.50 3.8	31.70 3.5	31.70 3.9	31.70 4.3	31.70 5.5	31.70 10	25.00 40	447.00 215.85

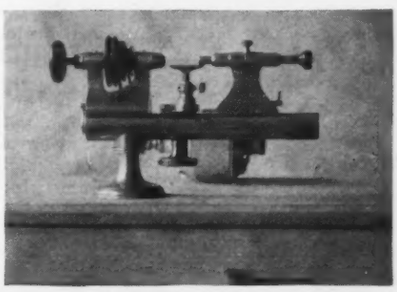
of this problem, the overhead systems committee of the Empire State Gas and Electric Association prepared the accompanying table. For example, the difference in cost installed between a 5-kva. and a 3-kva. transformer is $39 and the difference in yearly costs of operation is $5.95, as shown in the rectangle at the intersection of the vertical column 5 and the horizontal column 3. Referring to the table again, it is seen that the cost of changing from a 3-kva. to a 5-kva. transformer is $18.80. It is known that a 5-kva. will be required within a year and the question arises whether it would be cheaper to install a 3-kva. now and later replace it or to install a 5-kva. right at the start. From the table it is found that if a 3-kva. is used, it will not be economical to change to a 5-kva. for 38 months. These values are shown in the rectangle at the intersection of vertical column 3 and horizontal column 5. The table, of course, applies only to initial installations where a transformer is to be hung and a decision as to its size must be made. Where a transformer is in operation, there is no economy in changing until load conditions compel the change.

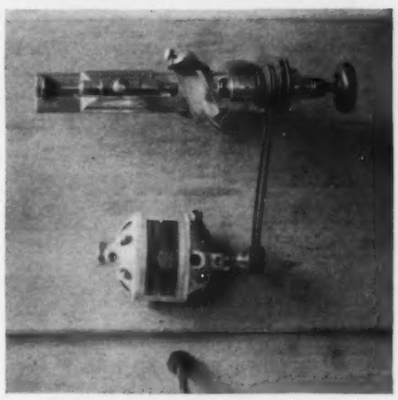
Various Uses for Jeweler's Lathe in Meter Work

THE lathe shown in the accompanying illustrations is being employed by the meter department of the Southern Power Company to polish sapphire jewels, clean top bearings, measure the eccentricity of top bearings (dial gage readily attached for such measurements), true up registers, make small shafts, etc. It has the advantage of being portable, the over-all dimensions of the box, which serves as the support and receptacle for chucks and tools, being 24 in. long, 11½ in. wide and 3 in. high. The box weighs about 20 lb.

The lathe is an ordinary jeweler's lathe driven by a series-wound sewing machine motor, the speed of which is controlled by a rheostat inside the case. The control lever extends through the front of the box. Besides the extra lathe parts kept inside of the box, a section has been provided in the right-hand end where small tools and the dial gage may be kept. Handles are to be put on each end for carrying.

The box was designed and constructed by A. C. Morrison, of the meter department.





MANY USES FOUND IN METER DEPARTMENT WORK FOR THIS PORTABLE LATHE

66-Kv. Line Built Through a Swamp

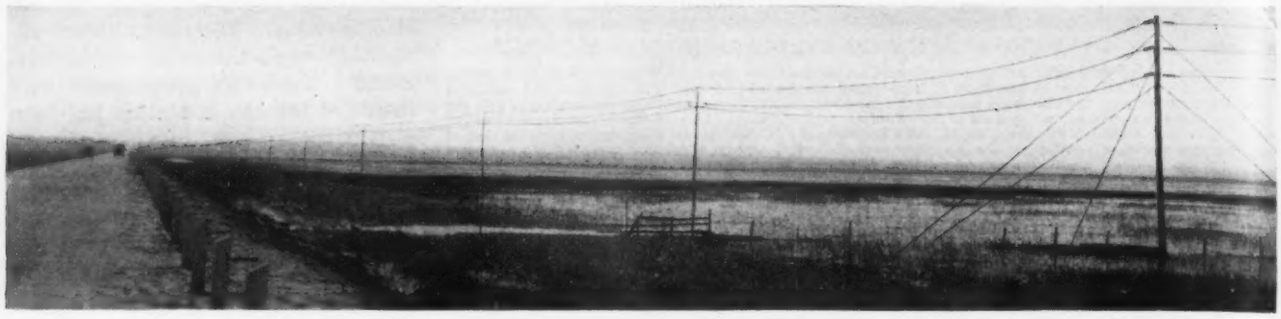
BY B. H. CUTLER
Construction Superintendent Hoosier Engineering Company, Indianapolis, Ind.

AN INTERESTING construction problem was encountered recently by the Hoosier Engineering Company in building a line for the Florida Power Corporation from Ocala to High Springs. The difficulty arose in getting across a 13,000-acre lake or swamp with an average depth of about 7 ft. and thickly overgrown with hyacinths. To build around it would have necessitated erecting seven miles of line, whereas the distance across was only two miles. The short course was decided upon, although it presented difficult construction and engineering problems.

At first it was planned to build the line along the edge of a causeway that crossed the swamp. However, this was impossible, as it would have conflicted with maintenance of the road. Finally the line of poles was located 200 ft. out from the fill. Construction was delayed as long as possible in order that the work could be done during the dry season. Work was started on Jan. 12 and was completed on Feb. 9.

Besides the two miles of poles directly across the lake, seventeen poles were set in 3 ft. of water along the edge of the swamp at an angle with the roadway. These 45-ft. poles were raised by means of a gin pole, using a Fordson tractor with caterpillar attachment for power. The tractor was also used to pull out the wire on the poles.

Directly across the swamp were erected twenty-three 50-ft. poles. The equipment used consisted of a Fairbanks-Morse 6-hp. engine with winch attachment mounted on one end of a 10x30-ft. barge. On the opposite end was mounted an "A" frame derrick 35 ft. high, which was guyed with messenger wire to the barge back of the engine. The en-



PORTION OF SWAMP ACROSS WHICH LINE WAS BUILT

gine was also equipped with a capstan attachment, which was used in moving the barge ahead.

Each pole was raised by using two three-sheave steel blocks with a steel cable. On each side of every pole a Mathew's "scrulix" anchor was set by hand power, the crew working from a raft made of oil barrels and planks. In the deeper water four anchors were put down, to which the pole was guyed until after it was set; then two anchors were taken out and the barge was moved ahead.

PREPARATION FOR POLES

Just ahead of the pole-erecting barge worked two men who prepared the hole for the pole. They worked from a small boat driving a 2-in. pipe casing at each pole site to a depth of 7 ft. below the bed of the lake, using a sand pump to clean out the inside of the casing. When lime rock was encountered, the pipe was driven down to the rock, a stick of dynamite put in, the casing removed and the charge shot. The casing was then put down again as far as possible, and if necessary the blasting was repeated. When the casing was down 7 ft., five to seven sticks of dynamite were inserted and the casing was removed.

After the pole-erecting barge had hoisted the pole into position above the charge and it had been guyed, the barge was moved away and the charge set off by means of electric blasting caps. The pole was then dropped into place, the guy ropes were removed and the barge was moved to the next pole. The poles were framed before distribution so that a lineman followed up the barge, putting arms on the poles and attaching guy wires.

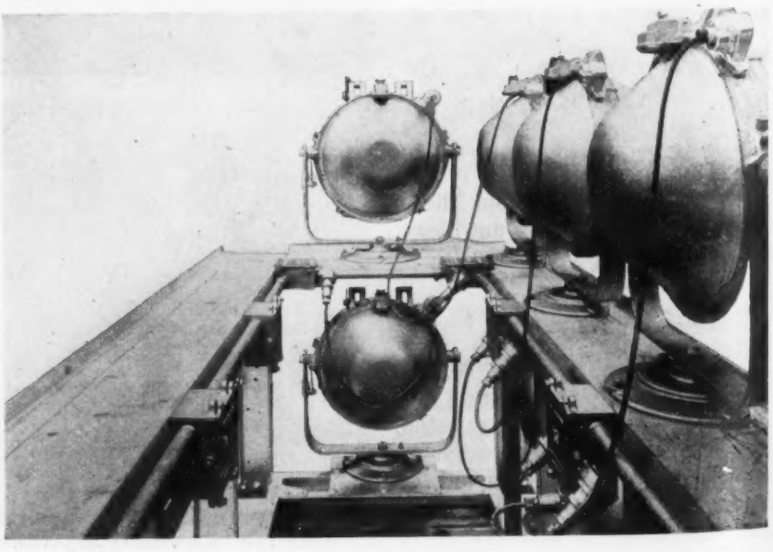
When the poles were all in place a reel wagon carrying the three reels of aluminum cable was placed on the barge and the wheels were removed. One conductor from each reel was dead-ended on a structure and the barge pulled itself back across the lake, unreeling the wire as it did so. The wire was pulled up and sagged with a tractor and blocks from the far side. The wire was dead-ended in the usual manner.

Flexible Arrangement of Floodlamp for Railroad Yards and Factory Grounds

THE "basket" containing the floodlighting equipment for this installation in the Wabash railroad classification yard, Chicago, consists of a 2 x 8-ft. platform provided with a trap-door entrance. The platform is surrounded on its four sides by two steel mounting decks, placed one above another and pre-drilled to receive the projectors. The two decks have a capacity of eighteen 23-in. projectors or a much larger number of smaller units.

Since the decks surround the platform proper, they provide an excellent safety railing and permit placing all accessories so that everything is within easy reach of the maintenance man. Raised edges on the decks keep tools or other paraphernalia from falling off. Provision is made for a hoisting davit for handling equipment, and a compartment under the floor of the tower "basket" serves for spare lamp storage.

Electrical distribution is effected through a conduit and eight outlet boxes that encircle the inside edge of the upper deck in easy reach of any one working there. These fittings, as well as the outlet and junction boxes on the tower proper, are built in as an integral part of the structure, giving added strength and security. Detachable plug connections permit individual control of projectors, which can be rotated for washing the face of the lens and returned to the same adjustment without refocusing. This arrangement likewise permits the cutting out of any individual lamp for servicing without interrupting power to the other projectors.



Commercial Activities and Public Relations

Cost of Accidents to Employees

By A. A. Rall

Safety Supervisor Kansas City Power & Light Company

IN 1925, 271 employees of the Kansas City Power & Light Company who had been involved in accidents found that their incomes had been depleted by $7,244.59, an average loss of $26.73 per victim. As a result of studying safety bulletins and paying attention to advices telling them to pick up the rusty nail instead of stepping on it, etc., the victims were able to reduce their number to 251 in 1926 and to cut down the lost-time cost to themselves to $4,229.45. This made the 1926 loss $17.10 per victim in place of $26.73 of the year before.

ANALYSIS OF ACCIDENT COSTS TO VICTIM

	Number of Lost-Time Accidents		Number of No-Lost-Time Accidents		Cost of Accidents	
	1925	1926	1925	1926	1925	1926
Jan.	16	9	4	1	$248.36	$120.52
Feb.	11	13	13	4	497.88	571.50
March	18	15	22	12	575.99	252.90
April	32	30	26	20	891.73	237.70
May	46	26	21	13	2,127.42	376.51
June	30	31	19	22	448.61	431.26
July	31	39	25	14	524.02	580.71
Aug.	19	23	14	21	453.10	399.83
Sept.	21	17	18	15	908.57	210.00
Oct.	18	22	8	9	223.88	254.49
Nov.	17	13	11	19	250.36	539.35
Dec.	12	12	8	11	94.67	254.68
Totals	271	251	190	161	$7,244.59	$4,229.45
Differences	20		29		3,015.14	

"Mill a Watt" Stimulated Lamp Sales

EMPLOYEES of the United Power & Light Corporation, at Hutchinson, Kan., made an interesting record in the lamp sales campaign that was conducted during the first half of February. A total of 11,009 lamp bulbs with an aggregate wattage of 664,361 were sold.

In this contest the regular sales force of the company was excluded. A commission of a mill a watt for each bulb sold was offered the other employees. A bonus of 5 cents was given for each carton of bulbs sold. Then, in order to add departmental competition to the contest, a prize of a 10 per cent increase in total commission was offered to the members of the department selling the most bulbs during the contest. Two other prizes, one of 7½ per cent and another of 5 per cent increase in commissions, were offered to the departments ranking second and third in the contest.

The contest was won by the cashier's department with a total of 3,505 lamps sold. Likewise, a member of that department made the largest individual number of sales, totaling 1,946 bulbs, which gave him a commission of $151.75.

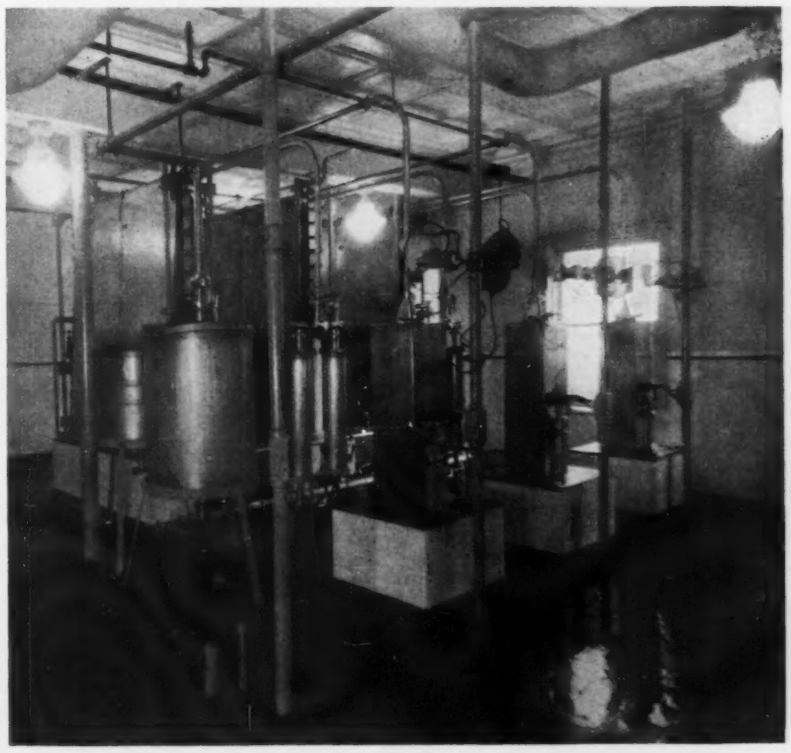
The accounting department was a close second in the contest, selling 2,854 bulbs. Not far behind came the line department with 2,575 bulbs to its credit.

The company paid out a total of $788.68 in commissions to the 65 employees who took part in the contest, and it is estimated that 15 per cent of the bulbs that were sold will go into sockets not in use when the contest commenced.

Pittsburgh Dairy Pasteurizes Milk with Electricity

By L. H. Lingeman

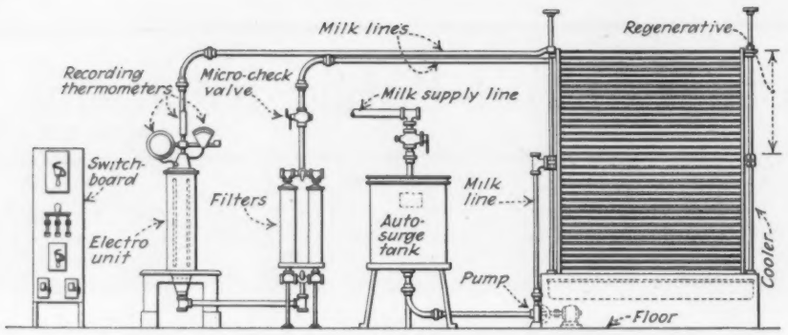
Power Sales Engineer Duquesne Light Company, Pittsburgh, Pa.



SIMPLE, COMPACT AND SANITARY ELECTRICAL PASTEURIZER REQUIRING 150 KW. AND TREATING 1,800 GAL. PER HOUR

ADVANTAGES of electric heat have been proved many times in many very interesting applications, but probably the newest development in this field has been the application of electricity for the pasteurization of milk and other liquids. A method known as the Electropure process has recently been perfected and placed in service in one of the largest dairy and ice cream plants in the Pittsburgh district.

Several years was spent in the design and testing of this equipment, and from the results obtained it is believed that it will find a wide appeal in the dairy industry and also afford the central-station companies a profitable load of very desirable characteristics.



SCHEMATIC DIAGRAM OF ELECTRICAL PASTEURIZING UNIT

The milk flows from the surge tank to a small centrifugal pump, which forces it up through the regenerative cooler. After leaving the cooler it passes through twin filters and then through the pasteurizing unit, then to the cooler, where it flows down the outside. As the heated milk passes down the upper half of the cooler it preheats the raw milk entering the coils. Brine is circulated through the bottom half of the cooler and reduces the temperature of the pasteurized milk to the point where it passes directly to the bottling machines.

The pasteurizer unit proper consists of two carbon electrodes spaced 3 in. apart by hard rubber blocks, forming a rectangular chamber 3x4x32 in., through which the liquid passes in an upward flow. The carbon electrodes are cooled by means of a water spray directed on the outside, which tends to prevent burning of the milk on the face of the carbon electrodes. Single-phase alternating current at 230 volts is applied to the electrodes, the milk acting as a conductor. The simplicity of construction has reduced maintenance compared with steam.

The proper pasteurizing temperature of 162 deg. F. can be held at a constant value by varying the speed of the centrifugal pump, thus controlling the flow of the milk through the heating chamber. A unit rated at 50 kw. has an hourly output of 600 gal. of milk per hour with raw milk at a temperature of 40 deg. F. The electrical input is constant through the operation. The liquid passes through the heating chamber in about twelve seconds, and this rapid, gentle and thorough treatment does not alter the milk in any way, excepting to reduce the bacteria content. The cream line remains unchanged, and as there is no change in the physical properties of the milk, the taste is not affected as in steam pasteurization.

The battery of three 50-kw. electric pasteurizing units illustrated shows very clearly the simplicity and cleanliness of the electrical method. It also illustrates the remarkable saving in space over the steam units shown in the other illustration. This item is an important factor in the overcrowded plants in the dairy industry which have difficulty in obtaining additional floor space as their business grows.

This electrical pasteurizer also has a possible field of application in pasteurizing fruit juices or other liquid foodstuffs.

The actual cost of electric energy for the electric pasteurizer has been somewhat higher than the actual cost of steam for operating a steam pasteurizer, but this difference in cost is more than offset by the saving in labor, maintenance and spoilage. However, it is felt that the cost of energy for operating the electrical equipment could be three times the cost of steam and still show an over-all economy in operation.

Steam equipment now in general use for pasteurizing milk requires a considerable amount of floor space and an enormous amount of piping and entails high labor and maintenance costs, whereas the electrical process mentioned requires but a

COMPLICATED MASS OF STEAM PIPING AND PASTEURIZING EQUIPMENT USED BEFORE ELECTRICAL PROCESS

small percentage of the floor space needed for steam equipment and reduces the labor and maintenance to a very low figure. Furthermore, it must be borne in mind that all of the pipes through which the milk passes in the steam pasteurizer must be taken down and washed with a cleansing solution at least once a day to prevent bacteria growth, so the item of maintenance is one of considerable importance. The schematic diagram gives a very clear idea of the simplicity of construction and consequently reduced maintenance with the electrical pasteurization process.

Refrigerator Selling in St. Louis

BY C. E. MICHEL
Sales Manager Union Electric Light & Power Company, St. Louis, Mo.

AS A RESULT of its experience in the past few years in the sale of electric refrigerators, the Union Electric Light & Power Company of St. Louis has come to the conclusion that the electric refrigerator is simply a piece of merchandise producing a valuable energy consumption and not a "different breed of cats" from the other appliances, the novelty of which has been rubbed off by time. Refrigerators will now be sold and serviced on exactly the same basis and by the same methods as are washing machines, vacuum cleaners, ranges or any other electrical appliances.

The company has consistently adhered to the proposition that merchandising, to be productive of profit and good will to the utility, divides itself naturally into two parts—selling the goods and keeping the buyer happy with them. Both of these functions are duties of the salesman, but he, being only human and therefore prone to err, may neglect one or the other as the conditions of his employment incline him. If he is paid a straight salary, it is usually found that looking after the interests of his customers (assuring himself and his company by assiduous contacts that Mrs. Jones' refrigerator is still working all right), takes up more of his time than does the making of additional sales. If the salesman works on commission alone, all his energy is turned to getting signatures on the dotted lines and it does not worry him if the washing machine he sold yesterday explodes with a loud report today.

The happy medium between the extremes of diversion of a salesman's time to one or the other of his functions is attained by assuring him a minimum wage plus a worth-while commission and then appointing a key man to see that he does the work his compensation is intended to cover. The refrigerator sales arrangement in effect in the Union Electric Light & Power Company provides for crews of six salesmen each, whose minimum guarantees range from $100 to $190 per month and who are paid a commission of 10 per cent on the selling price less installation of the machines they sell. To every six salesmen a supervisor is assigned, and it is his duty to check up on the customer-relations activities of the salesmen in his group. It is expected that this scheme will result in sales of 90 refrigerators per man in 1927.

The St. Louis company does not consider that the electric refrigerator is yet sufficiently low in first cost to justify the expenditure of time and energy in indiscriminate and general house-to-house sales solicitation. For this reason canvassing is confined to selected residential sections of the city, and this field is supplemented by prospect lists compiled from personal knowledge and inspection of ledger accounts. Personal solicitation is, of course, backed up by vigorous use of newspaper and direct-by-mail advertising.

Refrigerator servicing, except minor corrections that do not require expert knowledge on the part of the company trouble men, is taken care of by the local factory agents of the different machines. Service calls are received by the company and are routed on to the agent. The company assumes entire responsibility to the customer and protects its interests by the same kind of supervision as is given the salesmen. By confining its own selling efforts to one make of machine and by close watch of the activities of sellers of others, the company feels that it can prevent the service problem from becoming troublesome or acute.

Home Economics School Holds Electrical Short Course

CONSIDERABLE interest was shown in the home economics short course in electrical equipment which was held at Iowa State College, Ames, Iowa, for one week during the middle of March. It was the purpose of the program to give technical as well as non-technical information that would be useful to women interested in the electrical industry, in public relations work, publicity and advertising activities, and in the proper presentation of household equipment for use in the home. Special consideration was given to the problems of the homemaker. Instruction was in charge of Eloise Davison, associate professor of home economics, and Frank D. Paine, professor of electrical engineering.

VARIOUS INSTRUMENTS INSTALLED TO PERMIT TESTING HOUSEHOLD ELECTRICAL EQUIPMENT

Among the subjects covered in the laboratory exercises were: (1) Electrical units and measurements; (2) some applications of these to household equipment; (3) the processes of food preparation and preservation, dish washing, laundering and cleaning in the home.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Economic Production of Steam by Electricity.—C. J. WHARTON.—This article deals with the economic circumstances under which it becomes feasible to consider the operation of electrically heated boilers for the production of process steam. The author discusses in some detail the situation as he found it to have been worked out in Sweden and in Germany and to a smaller extent in Canada, Switzerland and Italy. From the information he was able to obtain it appeared that the two countries first named had by far the largest experience, had long ago passed the experimental stage and had numerous customers who were using electric boilers with complete satisfaction. —*Engineer* (*England*), March 11, 1927.

Reaction Steam Turbo-Generators.—An interesting steam-electric power plant has recently been completed at the modern chemical works of the Canadian Salt Company, Ltd., at Sandwich, Ontario. This article deals with the installation of reaction steam turbo-generators in this company's plant. The installation consists of two reaction steam turbines of a single-cylinder, back-pressure, pass-off type, designed to operate at a steam pressure of 300 lb. per square inch with a total steam temperature of 700 deg. F. The turbines run at a speed of 6,000 r.p.m. and exhaust against a normal back pressure of 20 lb. per square inch absolute, the exhaust steam being used for process work.—*Electrical News* (*Canada*), April 15, 1927.

Generation, Control, Switching and Protection

Alternating-Current Network Relay Characteristics.—D. K. BLAKE.—This paper discusses the required characteristics of relays for use with a low-voltage automatic network circuit breaker. The relay performs the two functions of tripping and reclosing the circuit breaker, and the characteristics required for each of these functions are discussed. The major part of the paper is given over to a discussion of the reclosing function because of the danger of "pumping" caused by cable-charging currents and various combinations of induction regulators and transformer connections. Emphasis is placed on the suitability of relays possessing watt-hour-meter characteristics, construction and adjustment involving only a different current coil and the replacement of the recording mechanism by standard relay contacts.—*Journal of A.I.E.E.*, April, 1927.

Selection of Circuit Breakers for Low-Voltage Applications.—BURT S. BURKE.—The dividing line between the cases in which an air-break circuit breaker should be used and those in which an oil circuit breaker should be used is somewhat elastic and subject to numerous qualifications. Different individuals have had varying experiences with circuit breakers and have drawn their conclusions from their own experiences. Since in some cases these experiences have been favorable to one type of breaker and in other cases to another, it is only natural that different opinions should result. However, there are certain definite considerations that affect the application of these two types of circuit breakers, and this article outlines these conditions.—*Power*, April 5, 1927.

Motors and Control

Electric Winding Engines for Collieries.—H. PRYCE-JONES.—This is an abstract of a paper read before the Mersey and North Wales student section of the British institution. The article deals with the general method and design features of winding gear in equipment such as is used for English collieries. Consideration is given to safety devices and to the types of brakes best suited for this class of service.—*Journal of Institution of Electrical Engineers* (*England*), March, 1927.

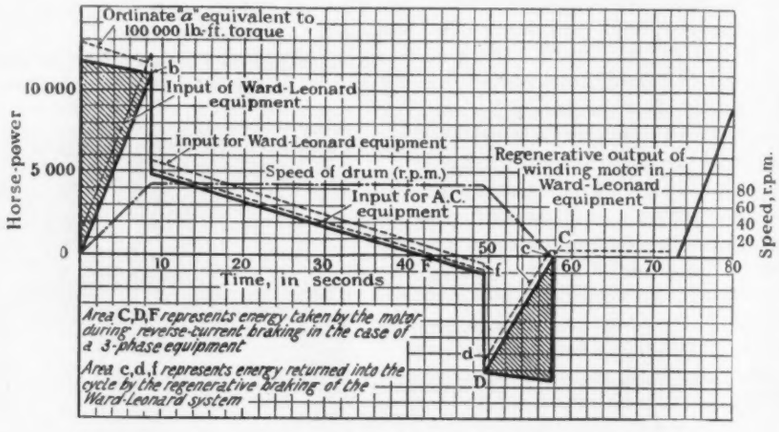


DIAGRAM SHOWING THE DISPOSITION OF THE VARIOUS LOSSES FOR THREE-PHASE AND WARD LEONARD SYSTEMS OF CONTROL

Units, Measurements and Instruments

Alarm Signal for Traveling Waves.—O. LOHAUS.—While klydonographs and certain vacuum-tube connections with a direct-reading electrometer of the sector type give accurate measurements of the magnitude of traveling waves and the overvoltages therefrom, they are both laboratory instruments and cannot be used readily for station service. A very simple instrument described in this article gives the operating engineer an acoustical signal when traveling waves enter the station over the transmission lines, without, however, disclosing anything about their magnitude. A short antenna wire is strung parallel to the incoming lines and is connected to a grounded inductance. Across the inductance is connected, over a shunted condenser, a vacuum tube, the plate circuit of which energizes a relay. The armature of this relay is kept attracted at all normal times. When traveling waves arrive a compensating action takes place in the vacuum tube, with the result that the relay releases the armature, which in turn temporarily closes a local alarm circuit. The entire equipment consumes only 50 watts.—*Elektrotechnische Zeitschrift*, March 3, 1927.

Microtome Methods for Preparation of Soft Metals for Microscopic Examinations.—F. L. LUCAS.—Preparing soft metals for microscopic examination has been a difficult task because of the ease with which these metals are deeply scratched by the abrasives. Lead and lead-cable-sheath alloys have been exceedingly difficult to study microscopically. Various investigators have described in the literature the methods which they have used in their work, and references are found describing different polishing techniques, cutting methods and some unusual procedures, such as flattening lead specimens against a glass plate. The polishing methods all seem to rely on subsequent deep etching to remove the scratches left by the abrasives. The cutting methods did not appear to offer marked advantages over the polishing methods because the cutting knife left even deeper scratches, seemingly, than the polishing methods. Methods which called for working or distorting the specimen were not of particular interest in most cases because of changes produced in the structure of the specimen. This paper gives a description of a sectioning method for soft metals and illustrations of its application to the study of lead-cable-sheath alloys.—*Bell Telephone Laboratory Reprint B-241*, March, 1927.

Transmission, Substations and Distribution

Non-Uniform Lumped Electric Lines. STUART BALLANTINE.—This is the first of a series of papers on the subject and deals with the conical line. It occurred to the author of this paper that the theory underlying the properties of the periodic electric networks formed of recurrent sections, discovered by G. A. Campbell, might be considerably extended to include lumped lines in which the values of the sectional impedances vary progressively from section to sec-

tion in accordance with some definite law. Accordingly, this paper deals with the mathematics involved in such a discussion, covering the elementary results of some of these old investigations.—*Journal of Franklin Institute*, April, 1927.

Steel-Tank Mercury-Arc Rectifiers.—E. B. SHAND.—This paper tells briefly of the work done by the Westinghouse Electric & Manufacturing Company on large steel-tank rectifiers between the years 1908 and 1918. The difficulties involved in the development of this type of apparatus are mentioned, with the continued efforts which were necessary to overcome them. Some of the design details of the rectifiers built are given, with the results obtained from them.—*Paper presented at the regional meeting, A.I.E.E., Kansas City, Mo.*, March 17, 1927.

Heat Applications and Material Handling

Non-Ferrous Electrothermic: Electric Brass Melting.—H. W. GILLETT.—Aside from electric reduction in fused salts and the making of ferro-alloys, electrothermic reduction of ores of the non-ferrous metals is not commercially practicable in America, according to the author of this paper. Electrothermics finds some application in annealing and heat-treatment of non-ferrous alloys, but its chief application is in melting. About 25 per cent of the type metal is electrically melted. Electric melting is practically standard for nickel and its alloys. Ninety per cent of the output of brass, bronze and nickel silver from the rolling mills and nearly 30 per cent of the output from foundries is melted in electric furnaces. Electric brass melting is now practically standardized upon three specific types of furnaces. Of the one thousand individual electric brass furnaces that have been built in America, more than 80 per cent have been of one or another of these three types. About 675,000 tons of brass, bronze and nickel silver were electrically melted in 1926, requiring 180,000,000 kw.-hr. Electric brass furnaces used $3,000,000 worth of electrical energy in 1926, used 40,000 fewer tons of fuel to generate the electricity than would have been used direct in fuel-fired furnaces, and saved 13,500 tons of metal that the fuel-fired furnaces would have lost.—*Paper presented before the American Electrochemical Society*, April 28, 1927.

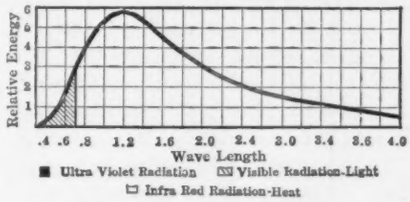
Traction

Flashover Tests on Chain Insulators.—W. STOERMER.—Doubts were expressed that a certain new type of high-voltage chain insulator has sufficient mechanical strength to support catenary railway feeders. To refute these assumptions a series of unusually severe electrical, mechanical and thermal tests were made, and these are described in detail in this article. A chain of these insulators was made to support a weight of 2,500 lb. for four months, after which time one of the chain members was flashed over continuously by an arc lasting five minutes. Although part of the porcelain petticoat broke off, a subsequent mechanical test stood a pull of more than 6,500 lb. for one-half hour, with actual rupture occurring at 18,000 lb. Another chain was dipped several times in molten lead (320 deg. C.) without any signs of mechanical weakening. Loads up to 16,000 lb. were carried by chains after these lead baths.—*Elektrotechnik und Maschinenbau*, March 13, 1927.

Illumination

Problems of Public Lighting by Electricity.—HAYDEN T. HARRISON.—In his introductory remarks the author recalls the paper on "Standard Clauses for Inclusion in a Specification of Street Lighting" read before the Illuminating Engineering Society (England) in 1913 and points out that there has been little advance in public lighting since that date. The explanation is generally to be found, according to the writer, in the fear of increased costs and additions to the lighting rate. Hence he seeks to show how the requisite improvement in illumination can be secured without rates being materially increased. — *Illuminating Engineer (England)*, April, 1927.

Light in Medicine and Surgery.—HERMAN GOODMAN.—The history of the use of light in medicine and surgery is traced from earliest times in this paper. The new and engrossing phases of modern light therapy and the theories of light energy are mentioned. The various types of apparatus offered the physician and surgeon for his work in treating and healing the sick are described, their good and bad points are mentioned, and the fields of each are outlined.—*Transactions of Illuminating Engineering Society*, April, 1927.



INCANDESCENT BULB CHARACTERISTICS

A Dual-Purpose Light. — J. S. HUGHES, R. W. TITUS, L. F. PAYNE and G. T. KLEIN.—A description of the results of a number of experiments conducted to determine the health-giving properties of ultra-violet radiation on several groups of chickens. Data are presented giving a comparison of results obtained by using sunlight filtered through ordinary window glass and also direct sunshine through an open window. Other tests were made, substituting a Cooper Hewitt lamp, direct sunshine being excluded, and the exposure period being varied from no irradiation up to eight hours per day. Six lots of day-old chickens were used for the purpose. The authors conclude from these tests that the Cooper Hewitt glass-tube lamps contained a sufficient amount of ultra-violet to be a distinct advantage when these health-giving rays are desired and also possess the advantage of containing no wave lengths short enough to produce any deleterious effect on the eyes.—*Transactions of Illuminating Engineering Society*, April, 1927.

Telegraphy, Telephony, Radio and Signals

Current Analysis in Circuits Containing a Resistance Modulator.—L. S. GRANDY.—The function of a resistance modulator is to produce in an electric circuit a current which is a copy of an exciting impulse such as heat or light waves. The study contained in this paper quantitatively analyzes by two methods the distorting effect produced in a circuit containing a modulator, a battery and a resistance for single-frequency modulation and by one of the methods for double-frequency modulation. An analysis is also developed for a special test circuit. The conclusion to be found from the study is that the relation between modulators and circuits is a design problem, the solution of which has not yet been altogether satisfactorily reached. — *Paper presented at the regional meeting, A.I.E.E., Kansas City, Mo.*, March 17, 1927.

Submarine Cable Progress.—E. S. HEURTLEY.—This article provides a short résumé of the actual results obtained on the duplicate system of the Pacific Cable Board submarine cable lines. The work involved the laying of two cables—one between Bamfield, on Vancouver Island, Canada, and Fanning Island, and the other between Fanning Island and Suva, Fiji Islands, the cable south of Suva having been duplicated in 1923. The duplication became necessary on account of the large increase in the volume of traffic between the Antipodes and the home country. The author compares results obtained on these new cables and the original cables which were installed in 1902.—*Electrician (England)*, April 1, 1927.

Miscellaneous

Five-Legged Transformer Core.—R. KÜCHLER. — Three-phase power transformers of very large output require iron cores, and, consequently, oil tanks of such tall construction that their complete shipment as a ready-for-service unit becomes impossible because of the limited railway clearance. Considerable savings in over-all height can be made if the iron core is designed with five legs instead of the customary three. The three middle legs carry the windings, while the outer two serve only as magnetic paths. It is thus possible to reduce the cross-section and height of the upper and lower horizontal yoke. Such core constructions have been in successful use for a number of years both here and abroad, but the author claims that their design loss distribution and theory in general are not as yet common knowledge. A semi-graphical method is developed for the accurate design of such cores which is based upon the permeability of the iron and the influence of the core joints as known values. The new method is explained by means of a practical example and the results are compared with a three-legged core. The comparison indicates about 12 per cent higher iron losses for the five-legged core but it is pointed out that the great advantage of being able to ship the complete transformer outweighs these additional losses. — *Elektrotechnische Zeitschrift*, March 10, 1927.

News of the Industry

For Inductive Co-ordination

N.E.L.A. and Western Union Telegraph Set Up Joint Committee, Following A. T. & T. Precedent

PREDICATING its action on the success which has attended its relations with the American Telephone & Telegraph Company concerning inductive co-ordination between telephone lines and power circuits, the National Electric Light Association, through President Robert F. Pack, has entered into negotiations with the Western Union Telegraph Company covering the same problems. It is proposed to establish a joint engineering subcommittee which will appoint further subsidiary committees for the purpose of carrying out detailed studies of certain phases of the problems encountered. Use will be made of the existing corresponding committees established with the Bell System. The general committee will include in its membership, besides the existing committee of the National Electric Light Association, O. D. Young, as general chairman; General Guy E. Tripp, neutral member, and Newcomb Carlton, president, and G. M. Yorke, W. C. Titley and E. Y. Gallaher, vice-presidents, for the Western Union Telegraph Company. On the joint engineering sub-committee the telegraph company will be represented by G. M. Yorke, vice-president; J. W. Milnor, research engineer, and J. C. Hubbard, general supervisor of lines.

Hagerstown Municipal Plant Extensions Forbidden

Granting the petition of the Potomac Edison Company, the Circuit Court in Baltimore on Tuesday set aside the Public Service Commission's order authorizing the municipality of Hagerstown, Md., to build extensions to the municipal electric plant and to issue bonds to the extent of about $300,000 to finance the extensions. The case will be taken immediately before the Court of Appeals by the city. It is said that it will be the sixth dispute to go before that court as a result of operation of the Hagerstown municipal plant. Litigation has gone on at various times since 1900.

Northern Washington Hydro Plants Planned

Preliminary filings for an electrical power project to be developed in two widely removed sections of Washington and costing $9,600,000 were placed with the State Hydraulics Office on April 23 by the Cascade Power Company of Seattle. Both units of this company would be on the slopes of the Cascade Range, 100 miles below the Canadian border, but the units would not be interconnected. President Lionel J. Bourke and Secretary Emory E. Hess of the company say that the combined output from the plants would approximate 77,500 hp.

On the westerly slope of the Cascades, near the Snohomish County town of Gold Bar, the company plans to establish the first unit, which would have an estimated output of 2,500 hp. and cost $1,250,000. Lake Isabel, near Gold Bar, would be dammed with a concrete structure, so as to inundate 178 acres and store 13,700 acre-feet of water. The second and larger unit would be in Tumwater Canyon, on the Wenatchee River, a mile south of the town of Chiwaucum in western Chelan County. Costing $7,500,000, this unit would, according to the plans, be begun on June 1, 1928, and should be completed by the same date in 1931. A 2,000-sec.-ft. appropriation would be necessary, and the reservoir would store 250,000 acre-ft. of water and submerge about 750 acres of land.

Interconnection Wins Triumph in Flood

Because of It Interruptions to Electric Service in Places on the Mississippi and Tributaries Are Far Less Serious than Would Otherwise Have Been True

THE eyes of the whole nation have been riveted for more than a week on the Mississippi River as the crest of an unprecedented flood has slowly passed southward on its way to the Gulf, overflowing thousands of square miles, destroying life, property and crops and causing dwellers on the river banks by the tens of thousands to flee to higher ground. The newspapers all over the land have told the story of the devastation, which so far has reached its acme in Arkansas and Mississippi, but they have had no room for reports concerning the way in which electric light and power service has stood up against the rush of waters. From New Orleans the ELECTRICAL WORLD as it goes to press receives the following summary of the electrical story so far as it had been told up to Wednesday night. It is a tale of service maintained under extraordinary difficulties and of the triumph of interconnection.

Interconnection between the transmission lines of the light and power companies in the flood area of the Mississippi River has more than demonstrated its value in the present crisis. With very minor exceptions, no towns have been without service, even though individual generating plants in several locations have been put out of service by the floods and in two cases struck by lightning and burned. Had not the towns in Oklahoma, Arkansas, Missouri and Mississippi been tied together many would have been without service at some time, and this is particularly true of the smaller towns. Besides the Mississippi itself, flood conditions have been particularly felt along the St. Francis, White, Arkansas, Ouachita, and Red Rivers, tributaries to the great stream.

In discussing the flood situation with the Southern editor of the ELECTRICAL WORLD on Wednesday at New Orleans, both Secretary Hoover and Major-General Edgar Jadwin said that the transmission lines in Arkansas had enabled virtually all towns to maintain electric service, and that in Greenville, Miss., even though the city was very badly flooded, the transmission line across the river from Arkansas had not gone out of service. Mr. Hoover and a corps of army engineers had just reached New Orleans after studying flood conditions on the Mississippi from Memphis south. In speaking of the general features of this area, Mr. Hoover said:

HOOVER DRAWS LESSON

"The nation should take a lesson from this flood. Approximately three hundred lives have been lost, two hundred thousand people driven from their homes, more than two hundred millions of dollars is lost, and the flood not yet over. The floods on the Mississippi or its tributaries can be controlled if adequate engineering works are installed. They would cost a minor part of the present loss. Thirty states have contributed water to this flood, but of more positive interest is the fact that no part of the nation can suffer a loss without that loss being reflected in every other part. The people in this vast region, who contribute so much to national wealth and prosperity, should be relieved of this anxiety and terror. It is a national problem and must be solved nationally and vigorously."

The Oklahoma Gas & Electric Company, serving along the Arkansas River, reports no serious interruptions of service. At Poteau, Ark., the local plant was struck by lightning and burned down. However, this section was tied into the rest of the system by means of transmission lines and service to customers was not interrupted. The Fort Smith Light & Traction Company, on the western edge of Arkansas,

is tied in with the system of the Oklahoma Gas & Electric Company, and though the local generating plant met with some difficulties in the production of energy, the city, owing to the existence of the tie line, did not lose service. Further along the Arkansas River, at Russellville, Conway, Little Rock and Pine Bluff, flood conditions were somewhat worse. These cities are served by the Arkansas Power & Light Company. In Russellville also the steam generating plant was struck by lightning and the generators were burned out, thus putting the plant out of operation. Here again interconnection prevented an interruption. In Little Rock there were from three to four feet of water throughout the city, and the basement of the steam plant was flooded. Here the generators were operated non-condensing. Another difficulty was encountered in that the water used for boiler make-up contained so much silt that it could not be filtered fast enough to meet the demands of the boilers. The plant is rated at about 18,000 kw., and owing to non-condensing and silt conditions was able to operate only at 3,000 kw. In Pine Bluff there was about eighteen inches of water on the main street, but service was not interrupted. In Clarendon the water was so high that service was discontinued on account of the fact that boats used about the city were in danger of coming in contact with the transmission and distribution wires. This town is on the White River. At Brinkley, just above Clarendon, service had to be discontinued for a few days.

The transmission line between Little Rock and Memphis has not been out of service during the entire flood period. This is also true of the line between Pine Bluff and Greenville, Miss. As stated above, the floods were very high in Greenville, but the Arkansas Power & Light Company was able to maintain whatever service was necessary. This town has been virtually evacuated.

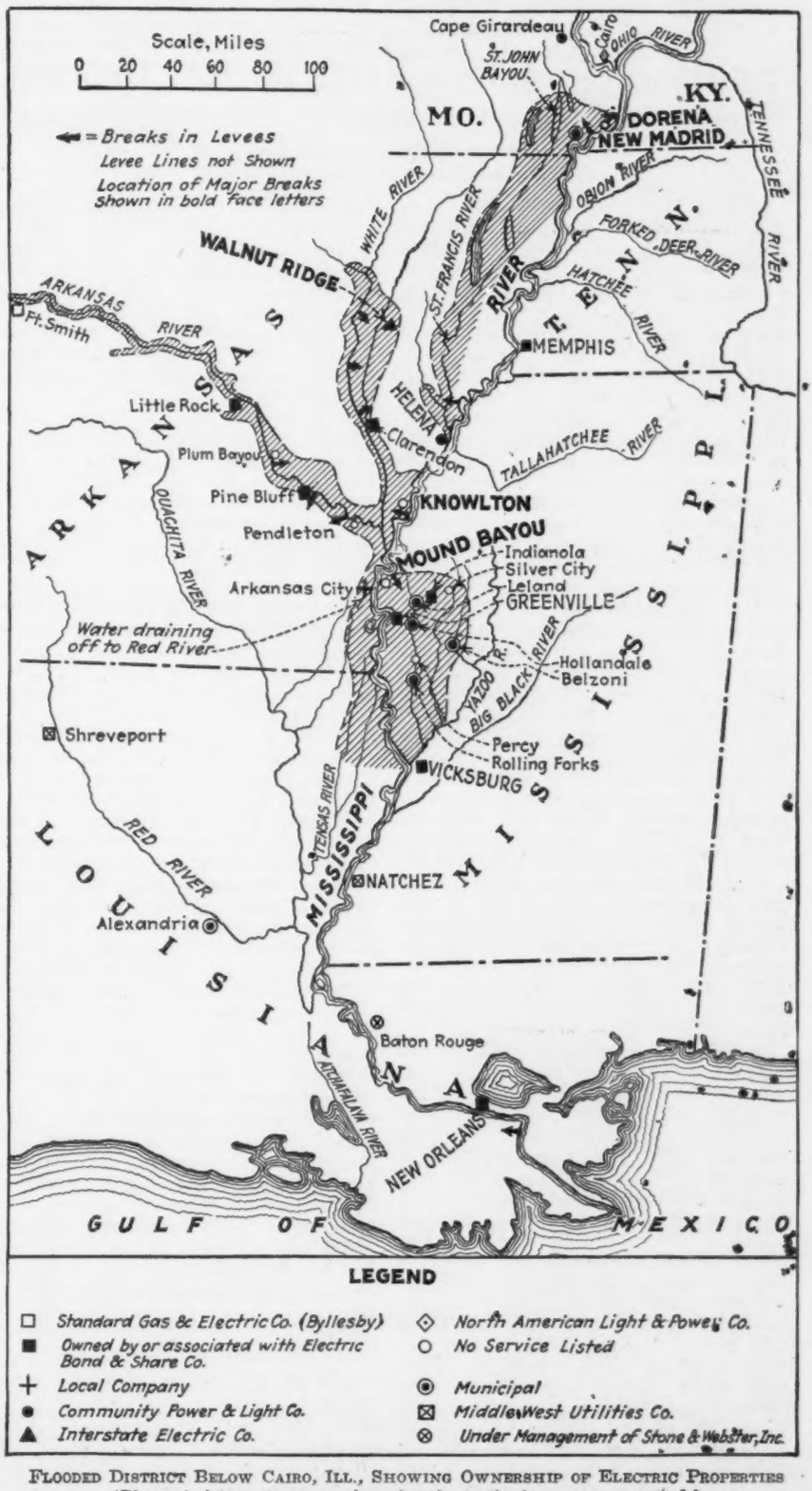
At the time this dispatch was written service at Vicksburg and points on the lower river had not been affected. The Southwestern Gas & Electric Company, serving the cities of Texarkana, Tex.-Ark., and Shreveport, La., on the Red River, has been able to maintain service, though the river has been somewhat high and some areas have been flooded.

To relieve conditions in New Orleans, where the Mississippi River is in danger of breaking levees, it was decided on Wednesday to break the levee at Poydras, which is about 20 miles below the city, on Friday. This will reduce the river level about two and a half feet, which is thought ample to meet the crest condition expected in ten days.

Operating Companies Heard From

Two dispatches sent to the ELECTRICAL WORLD at its request from the flooded districts—one from Arkansas and one from Mississippi—throw much light on the situation. From Pine Bluff, Ark., where the Arkansas Power & Light, Mississippi Power & Light and Louisiana Power & Light companies have their headquarters, L. V. Sutton, assistant general manager at Little Rock, wires that these three companies own and operate all lines rated above 13,000 volts in the area affected in the three states except in the vicinity of New Orleans and in southern Louisiana. The Arkansas company has in the flooded area 585 miles of line, the Louisiana company 100 miles and the Mississippi company 50.

Only three complete line failures have been reported. In these cases the trouble has been located by airplane and the lines repaired by men using motorboats. In one instance where structures were washed down temporary repairs were made by using guy wires between large trees, suspending the disk insulators. In another case extensions on top of the poles were necessary to keep the wires above the water. All but two small towns were supplied by duplicate lines following different routes. Substations in most instances where the flood was expected were protected by temporary or sandbag levees. In the power stations in some instances the condenser pits were



FLOODED DISTRICT BELOW CAIRO, ILL., SHOWING OWNERSHIP OF ELECTRIC PROPERTIES
(Places in heavy type are where breaks in the levees are reported.)

flooded, but interconnection provided service from other plants. "The crest of the flood is passing," said Mr. Sutton, "and we feel the worst is over."

From Jackson, Miss., C. P. Couch, general manager there for the Mississippi Power & Light Company, wires:

"The break in the Mississippi levee north of Greenville has resulted in flooding 2,500 square miles, or approximately 5 per cent of the total area in Mississippi. In this flood area there are 50 miles of 110-kv. lines and approximately 300 miles of 13,000-volt lines supplied from the natural-gas fields in Louisiana by a river crossing at Greenville. Service on these lines has not been affected, and we are patrolling the district by airplane and boat to insure continuous service. The isolated plants in this area have not been able to operate. Fuel supply has been cut off, and electricity can be supplied only by means of transmission lines. There are approximately 40 towns of more than 100 population in this flooded area, with a total population of 60,000 affected."

Southwestern Men Rally at New Orleans

Attendance Good Despite the Flood—President Flowers Attacks Public Ownership Advocates and Calls for United Action—National Officers Speak

ALTHOUGH many delegates were kept away by the flood conditions on the Mississippi, the thirty-second annual convention of the Southwestern Public Service Association and the seventh annual convention of the Southwestern Geographic Division of the National Electric Light Association, held jointly in New Orleans this week, were most successful. Advance registration indicated an attendance of about 800, but flood conditions cut this down to a little more than 500. The convention was officially opened by the Mayor of New Orleans, Arthur J. O'Keefe, with an address of welcome, to which response was made by J. F. Owens of the Oklahoma Gas & Electric Company.

The report of the public policy committee, presented by E. H. Kifer, pointed out that public utility operators have foreseen the necessity of power expansion long before the communities themselves have even realized its possibilities and that the very nature of the public needs has made the investment in these expansions a stupendous thing in the aggregate. It is the penalty of every great undertaking to be attacked because of its very size, and now, even before citizens have begun to realize the benefits which have accrued and are accruing to them by reason of this development, shouts that a monopoly is being built up and that great interests are seeking the control of the country are heard in the land. The public, Mr. Kifer said, must be told the facts in a comprehensive and clear form.

H. B. Flowers, president of the Southwestern Geographic Division, in his address, made in the afternoon of the first day, after reviewing the work of his section, said: "While much progress has been made, it is really only a beginning. Our work lies ahead, and though the vista looks rosy, there are big problems to be solved, mountainous obstacles to be overcome and, most unfortunately for both our own good and that of the people we want to serve, we shall have to turn aside in the immediate future from actual operating and service improvements to the distraction of combating a radical element that would undo all that we have done by hard work in the past few years and burden the people with uneconomic, unprogressive government ownership and operation." Mr. Flowers referred to the Muscle Shoals fiasco, the failures of municipal electric service and the possibilities of interconnection and attacked socialistic ideas. He condemned government construction and operation of hydro-electric plants under the guise of reclamation and flood control. Mr. Flowers concluded with a fervid plea for the industry to get behind the national, sectional and state electrical associations.

H. E. Borton, president of the Southwestern Public Service Association, reviewed the work done during the past year. W. H. Sawyer, president of the American Electric Railway Association, then gave an address on railway and bus transportation. R. F. Pack, president of the N.E.L.A., then spoke. He said that three years ago public relations was the keynote of the electrical industry situation, but now this matter was fairly well understood and well under way and the present problem before the industry was commercial development.

In the Wednesday morning general sessions E. L. Hinchliff, Middle West Utilities Company, spoke on the subject of "Wanted, a Sales Consciousness," giving specific examples of what can be accomplished in merchandising sales and commercial developments. Addresses were also made by O. H. Fogg, vice-president of the American Gas Association, on how all utilities should be co-ordinated from a national standpoint; C. B. Scott, Bureau of Safety, on "The Habit of Safety"; Paul S. Clapp, managing director of the N.E.L.A.; W. S. Vivian and others. The women's committee had a complete and attractive program. Sectional meetings, with very complete reports, well discussed, rounded out the convention.

E. E. Armstrong, vice-president Mississippi Power Company, Gulfport, was elected president of the Southwestern Division, and M. T. Walker, vice-president Southwestern Gas & Electric Company, Shreveport, of the Public Service Association.

Supply Jobbers' Association Arranges Program

May 2 to May 6 will see the Electrical Supply Jobbers' Association in session at the Greenbrier Hotel, White Sulphur Springs, West Va., for its nineteenth annual meeting. On Monday there will be three meetings of the executive committee, forming virtually an all-day session. On Tuesday committee meetings will fill the day.

An open general meeting is scheduled for Wednesday evening, with these three events: Address by E. W. Lloyd, vice-president Commonwealth Edison Company, on "The Relation of the Electric Light and Power Companies to the Electrical Supply Jobber"; address by Frank E. Watts, manager *Electrical Goods*, on "Making the Distribution Dollar Have More Sense," and the presentation of the James H. McGraw award by Earl Whitehorne, commercial editor ELECTRICAL WORLD.

General executive meetings are to be held on Thursday and Friday mornings, with a banquet on Thursday evening.

Orders New Mercury Unit

Success of Pioneer Installation at Dutch Point Leads Hartford Company to Put One in South Meadow

ON TUESDAY of this week a contract was closed between the General Electric Company and the Hartford Electric Light Company for the installation of a mercury boiler with mercury turbine, condenser and necessary accessories in an addition to the South Meadow generating station of the latter organization. This step is of great significance because it involves the design, construction and installation of a generating unit of about five times the capacity of the experimental installation which has been in use at the Dutch Point station in Hartford, and because it establishes the commercial employment of mercury vapor for the first time as a co-ordinated equipment unit applied to the systematic development of a high-grade central station.

Under this contract the equipment is expected to produce 10,000 kw. from the mercury-turbine-driven generator, and, in addition, about 125,000 lb. of steam per hour at the station pressure of 260 lb. and a temperature of approximately 700 deg. F., with an expenditure of fuel of 14,500 lb. per hour in coal with a heating value of 14,400 B.t.u. To a representative of the ELECTRICAL WORLD T. H. Soren, vice-president of the Hartford Electric Light Company, who from the beginning has had general charge of the mercury boiler and turbine development for the utility company, said that the new unit in the South Meadow station will deliver a total output of 20,000 kw. at a consumption slightly below 11,000 B.t.u. per kilowatt-hour.

An interesting phase of this development, Mr. Soren stated, is the fact that the value of the mercury equipment is by no means limited to base-load conditions. The pioneer unit at Dutch Point has a nominal output of 1,800 kw. and from 25,000 lb. to 30,000 lb. of steam per hour at 200-lb. pressure. During the high-water period the company receives a large amount of energy through interconnections with various hydro-electric systems in Connecticut, New York and Massachusetts. Under these conditions considerable correction is required. To provide this the company recently operated the mercury unit at Dutch Point in power production for a period of about nine hours, the station being heated for a 24-hour

period. During the nine-hour period the plant turned out 18,340 kw.-hr., burning over the total period a total of 18 tons of coal. On another day it operated the mercury unit, using steam for heating the building over a 24-hour period and producing energy for a nine-hour period. During this time 18,900 kw.-hr. was produced for a total of 15.25 tons of coal. Under normal conditions this station is capable of producing energy with a reasonable load factor on the basis of a 24-hour run on about 2 lb. of coal per kilowatt-hour.

Manufacturing has already been well launched on the South Meadow unit, and it is expected that it will be in operation some time in 1928.

In the Legislative Mill

Water Power Still Holds the Floor in West Virginia, Nebraska and Tennessee Capitols

THE water-power development fight in West Virginia was transferred to the Senate on April 22 when the House passed the Robinson substitute for the Water Power Commission bill. The vote was 75 to 13. A few days later it passed the Senate, and it now awaits the Governor's action, which is uncertain. The Keatley bill is dead. Delegate Edward M. Keatley, who was chairman of the Water Power Commission, asserted that the purpose behind the Robinson measure was to defeat water-power legislation at this session. Delegate Robinson, its author and Republican leader, declared his substitute was offered in good faith. The substitute would transfer control of water-power rights from the Public Service Commission, as provided in the Keatley bill, to the State Board of Public Works, composed of seven elected state officials, including the Governor. Another variation is that hydro-electric companies obtaining licenses under the new bill would not be allowed to export any energy from the state. One exception is made to this rule, railroads engaged in interstate commerce, and these would be limited to using power for their own needs. Speaker V. E. Johnson declared that the aim was to do "what North Carolina and Maine had done"—keep the state's power for its own citizens.

The ambitious plan of creating a public utility district made up of 87 Nebraska counties out of 93 for the development of water power for irrigation and production of electrical energy failed to pass in the closing hours of the Nebraska Legislature. The Senate passed the measure, loaded down with a number of amendments that were thought to make it impossible of acceptance by the voters, but the House was too busy with other matters in the short time the bill was in its custody to take it up. Members of the farm bloc sought to order it reported out for discussion and action, but failed. The Legislature passed a bill permitting the formation of hydro-electric districts by precincts and municipalities. These are to be created by a vote of the people within the boundaries designated and are to be governed by a board of directors which shall also fix rates. A 60 per cent vote of the qualified electors is required before the district can function. The bill was pushed by representatives of towns in the irrigated district of the North Platte Valley, where it is planned to buy energy from the government dam at Guernsey, Wyo.

The Tennessee House of Representatives has adopted, by 61 to 11, an amendment to the water-power bill that would set as a minimum $25,000,000 before a license is granted to develop Cove Creek basin in East Tennessee and which provides further that competitive bids must be offered for the project. A resolution was also passed authorizing the State's Attorney-General to take any action necessary to preserve the state's rights to that water-power site and to try to prevent its lease by the Federal Power Commission.

A bill has been introduced in the Wisconsin Assembly for the election of members of the Railroad Commission, who are now appointed by the Governor. The bill provides that the voters shall determine by referendum whether or not commission members shall be elected by the people.

A bill introduced in the State Senate of Wisconsin would make it possible for public utility corporations to acquire by condemnation lands which are not actually used for public utility purposes. It is claimed that this would include dams which have been built by public utility companies but are not in use.

Museums of the Peaceful Arts Are Opened in New York

The opening of the Museums of the Peaceful Arts in New York City took place on Wednesday evening, April 20, following a dinner meeting of the American members of the Newcomen Society. The Museums of the Peaceful Arts occupy temporary headquarters at the Scientific American Building, 24 West Fortieth Street, where a start has been made in organizing a great industrial technical museum for the city. A bequest from the late Henry R. Towne is aiding. The Newcomen Society is organized for the study of history and technology. Its headquarters are in London, but it has an active group in America.

Charles Penrose, American member of the council, presided at the meeting which followed dinner at the Engineers' Club. This meeting was held simultaneously with a meeting in London, and a paper on Marc Sequin and the invention of the tubular boiler was read at both gatherings. Following the dinner the group adjourned to the museums, where they were greeted by Dr. George F. Kunz, president, and surveyed the exhibits so far collected, which include a portion of the lightning rod which Benjamin Franklin erected on St. Paul's Cathedral.

A.I.E.E.'s Regional Meeting at Bethlehem

Industrial Applications, Lightning Protection, Circuit-Breaker Development and Rectifiers Receive Special Attention at Middle Eastern District Gathering

MORE than 350 men from electrical manufacturing concerns, public utilities, engineering college faculties and industrial plants interested in electrical applications attended the Middle Eastern District regional meeting of the American Institute of Electrical Engineers at Bethlehem, Pa., April 21 to 23 inclusive. About 70 cities and towns in ten states were represented, more than 20 per cent of the delegates being from other states than Pennsylvania.

If the amount of discussion be taken as a measure of interest, it centered in the papers on applications of electricity to cement mills (W. E. North), anthracite mining (E. B. Wagner) and rolling mills (L. A. Umansky), lightning protection of transmission lines (J. H. Cox), mercury-arc rectifiers (O. K. Marti and H. Winograd) and oil-circuit-breaker development (R. M. Spurck). Even the few remarks made regarding the paper on reducing distribution losses (J. B. Moorhouse) indicated a decided interest in some of the methods used. A preliminary report on progress of the A.I.E.E. committee on voltage standardization, in which B. G. Jamieson included preferred voltage ratings that will be submitted to the electrical apparatus committee at Pittsburgh May 3, was presented. Dr. Ernst J. Berg's reminiscences of Heaviside and Steinmetz were particularly entertaining, and Dr. Richards' outline of the modified engineering curricula at Lehigh University indicated an interesting educational experiment.

Notes on the papers and discussions at this meeting will be printed next week in the "Central Station and Industrial Practice" department of the ELECTRICAL WORLD.

Now It Is Company's Turn in Los Angeles Fight

An injunction prohibiting the city of Los Angeles from proceeding with construction of a harbor steam power plant has been issued by the Superior Court in a taxpayers' suit brought by the Southern California Edison Company. The injunction calls for the posting of a bond for $25,000 by the company. Funds of the Los Angeles Bureau of Power and Light have been mingled in an illegal manner, making it impossible to determine the character of the unappropriated balance, the court said. The city was declared to be unable to use funds derived from the sale of power to meet payments on a contract for the purchase of boilers for the proposed plant.

The Superior Court had previously refused to issue an injunction against the city in connection with the proposed power plant in another action brought by the Southern California Edison Company in which the company claimed that the action of the bureau constituted a breach of the contract which had been made betwen the company and the city. (See ELECTRICAL WORLD for April 16, page 822.)

Report on Lower Colorado

Points of Agreement Reached by the Three States, but Arizona Continues to Block Treaty

THAT the tri-state conference, made up of representatives of California, Arizona and Nevada, which has been attempting to reach an amicable conclusion relative to the approval of the Colorado River seven-state compact since last December, has reached a tentative agreement was made evident by the report of the California delegates to the California Legislature on April 20. The underlying question is that of bringing the three states of the lower basin of the Colorado into agreement as to allocation of water to permit development under the Swing-Johnson Boulder Canyon Dam bill. The three lower states have failed to agree concerning power to be developed from the dam, and the tentative agreement disclosed by the report is subject to a satisfactory agreement concerning power. The California representatives throw the blame for their inconclusive report upon Arizona.

The tentative agreement reached by the committees from the three states was as follows:

"1. That all waters of the Nevada tributaries of the main Colorado River are allocated in perpetuity to Nevada.

"2. That all waters of the Arizona tributaries of the main Colorado River, estimated by the Arizona committee as not more than 5,000,000 acre-feet per annum, are allocated in perpetuity to Arizona, with the right to store the water in and divert from such tributaries.

"3. To Nevada is allocated in perpetuity 200,000 acre-feet of water per annum from the main channel of the Colorado River.

"4. The entire balance of the waters of the main channel of the Colorado River, estimated at about 9,000,000 acre-feet per annum, is allocated in perpetuity in the ratio of one-third to Arizona and two-thirds to California, each of these two states to supply the Mexican allowance, if any, in proportion to the allocation from the main stream of the Colorado River.

"5. All water in the main channel of the Colorado River not put to beneficial use, or for the use of which works have not been actually constructed, shall, after the expiration of 25 years, be open to appropriation or use by either state.

"6. That the Colorado River compact shall be approved by the three states."

The report states further:

"No agreement as to revenue from power, tentative or otherwise, has been reached, and the Arizona committee has refused to consider seriously any further or final agreement as to the division of water until an agreement has been reached as to the revenue that the state will receive from the power development, insisting that Arizona must receive revenue even if the development is made by federal government funds."

The Legislatures of Arizona and Nevada have appointed permanent commissions. The existence of the California committee making this report comes to an end on April 30. A proposal to create a permanent official California commission was presented by a member of the Los Angeles City Council on April 18. The resolution would have the commission authorized by the State Legislature and appointed by the Governor. It would consist of six members, two appointed from the state at large, two appointed at the suggestion of the city of Los Angeles and two at the suggestion of the Imperial Valley.

Purchases and Mergers

United Public Utilities Buys Many Small Plants—Philadelphia Electric to Purchase Northern Maryland—Oklahoma Power Absorbs Public Service of Oklahoma

RECENTLY organized with a New Jersey charter, the United Public Utilities Company, of which all the stock is owned by the United Public Service Company, will, in addition to a gas business and to ice supply in Louisiana, furnish electric light and power to 15,000 customers in 71 small communities in Ohio, Indiana and North and South Dakota where generating stations rated at 6,150 kw. and transmission and distribution systems have been acquired. The main steam station is at Greenville, Ohio, and there are hydro-electric stations at Covington and West Milton, Ohio, and a Diesel-engine plant at Winchester, Ind. The Ohio-Indiana properties fall into three groups which are to be interconnected. Greenville has been served by the Greenville Electric Light & Power Company, Covington by the Buckeye Light & Power Company and Winchester by the Citizens' Heat, Light & Power Company. Forty-two towns in the Dakotas, mainly interconnected, will be served, the system extending from Frederick, S. D., and Ellendale, N. D., west to Lemmon, S. D., and south to Blunt, S. D.

The Philadelphia Electric Company has just entered into a contract for the purchase of the Eastern Power Company, the Southern Pennsylvania Power Company and the Northern Maryland Power Company, formerly owned and controlled by John Ware, Jr. A statement issued on Monday said: "It is the intention of the Philadelphia Electric Company to supply the territory in which the above-named companies operate from Conowingo, as soon as this great hydro-electric plant is in operation, early next year. In the meantime, improvements to the transmission and distribution lines and substations will be undertaken in order to provide and insure continuity of service. It is believed that intensive development in Cecil and Harford Counties, Md., will result." The Eastern Power Company is a holding company. The Southern Pennsylvania Power Company operates in the towns of Russellville, Cochranville and Oxford. The Northern Maryland Power Company acquired the property of the Elkton Electric Company, Northern Maryland Electric Company, Home Manufacturing Light & Power Company and the Havre de Grace Electric Company. The rivalry between the Northern Maryland and the Consolidated Gas, Electric Light & Power Company of Baltimore for the Havre de Grace territory has been chronicled in previous issues. (See ELECTRICAL WORLD, April 23, page 881.)

Acquisition of all the properties of the Oklahoma Power Company of Okmulgee, Okla., by the Public Service Company of Oklahoma is announced. Thirty-four communities in southeastern Oklahoma will be added to those already served by the latter company as a result of this move, bringing the total up to 70. The Oklahoma Power Company was a subsidiary of the American Public Service Company. All the companies concerned are Insull properties. With this addition the Public Service Company of Oklahoma, whose headquarters are at Tulsa, will operate in twenty counties in that state; its total generating capacity will be 43,180 kw. and it will have 690 miles of high-tension transmission lines. There is now under construction a modern steam generating station at Weleetka, with an ultimate capacity of 45,000 kw., of which the first 15,000-kw. unit will be completed by the end of 1927. The combined company will be controlled, through the Central & South West Utilities Company, by the Middle West Utilities Company.

Sale of the property of the Beatrice Power Company, owner of a hydro-electric development at Barneston, on the Blue River south of Beatrice, Neb., has been announced. The purchasers, whose identity is not disclosed, are represented by Carson, Goldsmith & Company of Chicago, a brokerage house. Twenty-five thousand dollars has been put up for a ninety-day option at a price of $487,500. Negotiations have been in progress by the same brokers with the Gage County Electric Company and with a company serving Odell and a few towns near the Kansas state line, but President Shaffer of the former company, which owns two developments at Blue Springs, denies that any deal has been consummated.

The Adirondack Power & Light Corporation has been authorized by the New York Public Service Commission to acquire the outstanding stock of the Consolidated Electric Company of Greenwich, N. Y., which serves also Cambridge, Victory Mills, Schuylerville and adjoining rural communities.

Approval of the Kansas Public Service Commission is expected soon on the application of the Kansas Power & Light Company, Topeka, to consolidate several of its holdings. The consolidation will bring into one corporate organization the Topeka Edison Company, the Topeka Railway Company, the Kansas Public Service Company, the Union Power Company and the Kansas Power & Light Company. With

its affiliated interests the Kansas Power & Light Company is the largest public utility in the state. All holdings of the Rossville Electric Light, Ice & Elevator Company, including franchises for electric service, were recently sold to it.

City commissioners of Kansas City, Kan., have declined an offer for the municipal water and light plant of $10,000,000 cash from Minck & Oleison, a Tulsa (Okla.) firm with New York affiliations. The offer embodied a proposal to supply energy for street lighting at 1 cent per kilowatt-hour. The Kansas City Power & Light Company recently offered to purchase the electric unit of the plant. That offer also was rejected.

Oswego, Kan., voted on April 19 by 453 to 54 against the sale of the city plant and the granting of a franchise to the Kansas Electric Power Company, Lawrence. This makes only three times in the last four years that any Kansas city has voted down a power company's proposal to serve the community.

Fort Collins, Colo., on April 19 decisively defeated the charter amendment referred to on April 2 which was designed to make possible the acquisition and operation of public utility properties and had for its main purpose the flotation of bonds to take over the electric light plant of the Public Service Company of Colorado. Opponents of the proposed amendment organized as the Civic League and argued that the plan would give the city authorities power to issue bonds in unlimited amounts and would thus encourage extravagance. An opportune reduction in rates by the company aided their efforts, and the amendment was lost by a vote of 1,518 to 888.

For the second time the voters of White River, S. D., have carried a proposal to sell the municipal plant, this time by 129 to 5. The first election was voided on a technicality.

Sale of the electric light plant at Orr, N. D., by O. W. Zerrull to the Otter Tail Power Company has been approved by the North Dakota Board of Railroad Commissioners.

Catlin (Ill.) voters have authorized the leasing of the municipal electric light plant to the General Utilities Corporation by a vote of 257 to 102 under a 20-year franchise.

St. Matthews, S. C., voted unanimously on April 12 to sell the municipal electric light plant to the Broad River Power Company for $50,000.

The City Commission of Clarksdale, Miss., has asked for bids for the municipal light plant. Some citizens are protesting and threatening to take every means to prevent the sale.

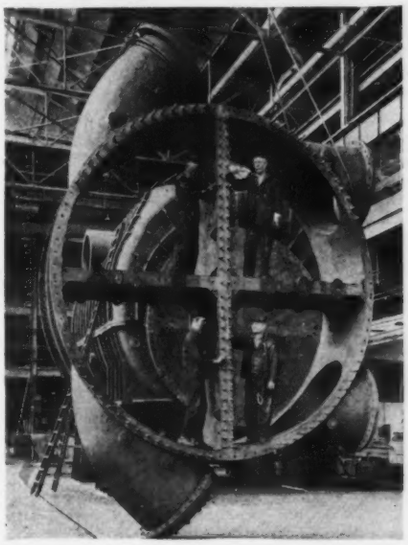
Covington, Tenn., has, through its mayor and aldermen, refused to indorse a proposed act of the State Legislature calling a city election to decide whether to sell the municipal light and power plant to the Memphis Power & Light Company.

The California-Oregon Power Company, with headquarters in San Francisco, has applied for permission to purchase from the Keno Power Company of Keno, Ore., the latter's system, covering Klamath Falls and Keno. The price is estimated at $260,300.

Briefer News

Laclede Power & Light to Expend a Million on Expansion in St. Louis.—The Laclede Power & Light Company, which is operating the electric properties of the Laclede Gas Light Company under lease, will spend $498,000 in enlarging the generating plant at Main and Mound Streets by the addition of a 12,500-kw. turbo-generator with auxiliary equipment and $444,200 on distribution lines and accessories. In all, its outlay will exceed $1,000,000.

Mammoth Condenser for Colfax Station Almost Completed.—This inlet water chamber of a condenser with a surface area of 62,500 sq.ft., one of two



being completed at the South Philadelphia works of the Westinghouse company for the Duquesne Light Company's Colfax station at Pittsburgh, weighs 36,000 lb., is nearly 24 ft. high and weighs 600,000 lb. The condenser is fitted with a total of 10,840 single-tube sections, the tubes, made of Admiralty metal, being 1 in. in diameter and 22 ft. 3 in. in length. When in operation with both of its circulating pumps, each passing 36,250 gal. per minute, the condenser will handle 104,500,000 gal. of water per day.

British Columbia's Yet Undeveloped Water Power.—According to a statement by T. D. Pattulo, Minister of Lands in the British Columbia government, reservation of water powers representing 1,000,000 hp. and conveniently situated to meet the requirements of the industrial centers of the coast district of that province has been carried out. The reserve covers the unrecorded waters of the Chilco and Whitewater Rivers and their tributaries, including Whitewater Lake, and of the Homathko and Southgate Rivers and their tributaries. The prospective water powers are in the Lillooet district and less than 200 miles north of Vancouver. It is the intention of the provincial government to have a reconnaissance made of the situation in the coming summer.

Commissions of Two States Hold Joint Hearings. — In evaluating the property of the Cumberland & Allegheny Gas Company in Maryland and West Virginia joint hearings have been held in the last six months by the public service commissions of the two states, and their engineers worked together. Harold E. West, chairman of the Maryland commission, said that this was the first time that body had appraised property in another state for rate-making purposes.

Montana Water Power Described.—Members of the Montana Society of Engineers from various sections of that state journeyed to Butte on April 11, when a regular meeting of the organization was addressed by Frank Scotten, manager of the Great Falls district for the Montana Power Company and general superintendent of construction for that company. Mr. Scotten's subject was "Water-Power Development in Montana," and his talk was illustrated by films lent by the Westinghouse Electric & Manufacturing Company.

New Transmission Lines for Eastern Oregon.—The Eastern Oregon Light & Power Company of Baker has contracted with the Idaho Power Company for a supply of electrical energy to be delivered at Durkee, Ore., and with the Eastern Oregon Development Company to construct the necessary transmission lines and substations. The line will be rated at 66,000 volts, single-pole construction, built on private right-of-way, and will be capable of adding 10,000 hp. to the Eastern Oregon company's output.

Oklahoma Gas & Electric Company's Program.—Two 6,000-kw. turbo-generators with other equipment are to be added to the Oklahoma Gas & Electric Company's plant at Byng, Okla., this year, tripling its present capacity. Other extensions include a new 63-kv. transmission line from the company's Harrah generating station to connect with its present line west of Maud and also a 26-mile line from Chandler to Drumright, making better connection with the Riverbank plant, near Muskogee. A third line will extend from Shattuck to Fargo.

Consumers Power Company Aids Kalamazoo's Plans.—At Kalamazoo, Mich., the Consumers Power Company's new 20,000-kw. turbine is being moved into the rebuilt local power plant. One boiler is completed and ready for its drying out, coal pulverizers are in place, and it is the company's plan to have the new unit ready for operation on July 1. The company is working in cooperation with the city in making the surroundings at the new plant conform to the city's plan for beautification of the river banks and to the architectural lines of a new bridge. At Lansing the company's engineers are experimenting on its 140,000-volt transmission line skirting the northern city limits in an effort to eliminate radio interference, and further experiments to the same end are being conducted at Battle Creek. The company reports from its headquarters at Jackson enough coal in storage to assure operation of its elec-

tric department four or five months. More is being added, and no fear of the strike is felt.

Hearing on Hiwassee River Project.—A public hearing will be held in Athens, Tenn., on May 6 regarding the issuance of permits for dams on the Hiwassee River in Polk County to the Hiwassee Power Company, which wishes to make five hydro-electric developments between Austral and the Tennessee-North Carolina state line. Later the application may be modified to include six developments, the sixth to be a short distance below the Tennessee-North Carolina state line, flooding water back into North Carolina as far as Shoal Creek.

Gouverneur (N. Y.) Municipal Plant Has Construction Troubles. — R. E. Stockham, who has been engaged in the construction of a municipal hydro-electric power plant in Gouverneur, N. Y., on the Oswegatchie River, for a year and a half, has encountered many difficulties, especially with the coffer-dams, two of which were washed away, and has relinquished his contract. The work will be finished by the village with its own force of workmen. The power house proper has been finished several weeks, and all that remains to build is the last section of the concrete dam.

Indiana Public Service Commission.—Two members of the Indiana Public Service Commission, concerning which body's policies and personnel there has long been strife in that state, have retired—Frank Wampler and Clyde Jones. The Governor has appointed to succeed them former State Senator Harmon and a member of the federal vocational board, Mr. McIntosh. He has reappointed Howell Ellis, former secretary of the board, who was first made a commissioner when Samuel M. Artman was transferred to the State Industrial Board a few months ago. Chairman J. W. McArdle and Commissioner F. T. Singleton remain in office.

Pecos River to Furnish Power for Oil Fields. — The Pecos Valley Utilities Company, a subsidiary of the Kansas City Power & Light Company, will construct a dam and hydro-electric plant on the Pecos River near Girvin, in southwest Texas. The company has entered into contracts with the larger companies operating in the Crane-Upton county oil fields for the electrification of their well-drilling and pumping equipment. Similar contracts have been made with companies operating in the Reagan County field. A network of wooden-pole transmission lines will cover an area of probably a hundred miles around the central power plant, it is asserted. Besides this, an application to the State Board of Water Engineers for a permit to make surveys of the water-power resources of the Pecos River is reported to have been received from the Central Power & Light Company, which, it is said, has under consideration plans to build three dams across the river near Langtry and Shulma, where there is a deep canyon. Hydro-electric plants would be installed.

Kennebec Reservoir Company Chartered in Maine. — Unattended at any stage of its progress by the determined opposition which led to its final defeat four years ago, the Kennebec Reservoir Company charter measure has been enacted by the Maine Legislature and signed by Governor Brewster. It will become effective in mid-July. This bill confers upon the Central Maine Power Company and certain industrial companies on the Kennebec River the right to build a storage dam at Long Falls on the Dead River, the state leasing for 50 years public lots on the stream last named.

Missouri Association of Public Utilities to Meet at Cape Girardeau.—An outline of the program adopted for the twenty-first annual convention of the Missouri Association of Public Utilities, to be held at Cape Girardeau, Mo., on May 5 to 7, lists as speakers at the general sessions D. H. Taylor of St. Louis, on the mutual responsibilities of the utilities and the public; Frank Shelton of Joplin, on continuity of electric service; H. H. Kuhn of Kansas City, on rate schedules to promote use of service; Prof. J. C. Wooley of Columbia, on farm service, and Miss Georgia Downey of St. Joseph, on women's work. At the electrical sessions the papers will include one on refrigeration by G. W. Rauch of Joplin and one on stimulating better lighting by W. J. S. Wharton of St. Louis.

Coming Meetings of Electrical and Allied Societies

Electrical Supply Jobbers' Association —Greenbrier Hotel, White Sulphur Springs, W. Va., May 4-6. Franklin Overbagh, 411 South Clinton Street, Chicago.

Empire State Gas and Electric Association, Accounting Section—Hotel Niagara, Niagara Falls, N. Y., May 5-6. E. Johnston, Syracuse Lighting Co., Syracuse, N. Y.

Missouri Association of Public Utilities —Hotel Idanha, Cape Girardeau, May 5-7. F. D. Beardslee, 315 North 12th St., St. Louis.

Arkansas Utilities Association—Hot Springs, Ark., May 16-18. R. I. Brown, Arkansas Central Power Co., Little Rock.

Middle West Division, N.E.L.A. — Topeka, Kan., May 18-20. H. M. Davis, 1519 O St., Lincoln, Neb.

American Society of Mechanical Engineers—White Sulphur Springs, W. Va., May 23-26. C. W. Rice, 29 West 39th St., New York.

Canadian Electrical Association—Clifton Hotel, Niagara Falls, Ont., May 25-27. J. B. Woodyatt, Southern Canada Power Company, Montreal.

American Institute of Electrical Engineers—Northeast District, Pittsfield, Mass., May 25-27; summer convention, Detroit, June 20-24. F. L. Hutchinson, 36 West 39th St., New York.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., May 28-June 4. S. N. Clarkson, 420 Lexington Ave., New York.

American Association of Engineers—Tulsa, Okla., June 6-8. M. E. McIver, 63 East Adams St., Chicago.

National Electric Light Association—Atlantic City, N. J., June 6-10. Paul S. Clapp, 29 West 39th St., New York.

Pacific Coast Electrical Association—Santa Cruz, Cal., June 14-18. S. H. Taylor, 447 Sutter St., San Francisco.

Northwest Electric Light and Power Association—Salt Lake City, June 21-24. C. W. Lundquist, Utah Power & Light Co., Salt Lake City.

North Central Division, N.E.L.A.—Lake Superior steamboats from Duluth, June 24-28. J. W. Lapham, 351 Loeb Arcade, Minneapolis.

Northern Ohio Power & Light Company's Budget.—To the estimated expenditure of Ohio light and power companies in 1927 printed on page 670 of the issue for March 26 should be added more than $1,800,000 to be spent by the Northern Ohio Power & Light Company of Akron on its electric division, exclusive of railway and miscellaneous improvements. Additions to the South Akron substation will be made increasing the capacity from 50,000 kw. to 75,000 kw., new power equipment will be installed at the Gorge and Kenmore substations and a new high-tension switching and distributing plant will be installed to take care of increased load in Barberton and Wadsworth.

An Equatorial Utility Enterprise.—Extraordinary records are reported to have been made by American electrical and railway equipment in the city of São Luiz, capital of the State of Maranhão, Brazil, which is only 3 deg. south of the equator. The city has 60,000 inhabitants, and its lighting plant, 20 miles of street railway, waterworks and sanitary system, completed in 1925, have for a year past been operated with success by the Ulen Management Company. H. F. Isler, who for years was connected with Stone & Webster, is in charge as administrator for the government and manager for the company.

Mayor Says St. Joseph, Mo., Saves Money Under Private Light Supply—Purchase of electrical energy from the St. Joseph Railway, Light, Heat & Power Company under a contract with the city has saved the taxpayers of St. Joseph, Mo., more than $20,000 in the fiscal year which ended April 19, according to figures given out by Mayor Louis V. Stigall. The city's light bill for the fiscal year 1925-26, with municipal ownership, according to figures compiled by the deputy comptroller, was a little more than $59,000, as compared with slightly more than $39,000 for the fiscal year of 1926-27, with the Doherty company furnishing the service.

Substantial Rate Reductions in Virginia.—A general reduction by the Virginia Electric & Power Company in its residence rates on electric lighting and its combination residence rates on electric lighting and appliances throughout Virginia has been authorized by the State Corporation Commission. Power company officials estimate that the reductions will mean a saving of more than $200,000 a year to residential light and power users. In Richmond, Norfolk, Petersburg, Portsmouth and intermediate points the rates on lighting will be decreased from 10 cents per kilowatt-hour, with 10 per cent reduction for prompt payment, to 8½ cents, with no discount, and the combination rate will be lowered from 9 cents net to 8½ cents net. In the group of smaller

cities and towns, including Williamsburg, Fredericksburg, Bowling Green and Rappahannock the present lighting rate of 15 cents net will be reduced to 13½ cents for the first 100 kw.-hr. All of the foregoing reductions are to be effective May 1.

Okmulgee-Tulsa Transmission Line Finished.—The Oklahoma Power Company has completed its new transmission line connecting Okmulgee, Henryetta and other places with the power plant of the Public Service Company at Tulsa. The Oklahoma Power Company is constructing two substations at Okmulgee and Henryetta, respectively, and when the Public Service Company finishes the 15,000-kw. unit of its new generating plant near Weleetka, already reported, all cities and towns in the territory served by the two companies will have the advantage of connection with two large central stations.

Puget Sound Power & Light Again Cuts Rates.—The Puget Sound Power & Light Company of Seattle announces a voluntary reduction of approximately 12 per cent in residential and commercial lighting rates in Whatcom, Island and Snohomish Counties, Wash., with the cities of Everett, Lowell and Bellingham excepted. Residential rates are cut from 8½ cents a kilowatt-hour for the first 55 kw.-hr. to 7½ cents a kilowatt-hour for the first 60 hours, and commercial rates are reduced 1 cent a kilowatt-hour. This is the second reduction in two years and affects 6,000 rural customers, 7,000 town and city customers and 40 towns and cities.

Tornado Interrupts Power Transmission from Keokuk.—The tornado which on April 19 swept a section of eastern Missouri and central Illinois, killing twelve persons and injuring a hundred, leveled about three-fifths of a mile of the two transmission lines connecting St. Louis with the Keokuk Dam. The break occurred at Elsberry, Mo., just before noon and crippled electric service in St. Louis until about 5:30 p.m. Trolley cars on some lines were put out of commission for almost six hours. In the emergency extra equipment at the Ashley Street plant of the Union Electric Light & Power Company and at two power plants of the United Railways Company was put into service.

Increased Head Possible at Paugan Falls on the Gatineau.—Officials of the Gatineau Power Company report the possibility of the development of a 135-ft. head at Paugan Falls and 95,000,000,000 cu.ft. of storage at Bitobe, in the Gatineau district of the Province of Quebec. The initial plans called for a head of but 115 ft. and storage of 82,000,000,000 cu.ft. When the power plant at Paugan Falls is completed there will be an installation of eight electrical units as compared with five at the Chelsea and Farmers' Rapids plants. This will give an ultimate installation of nearly 600,000 hp., but the machinery first installed will aggregate only about 80 per cent of this total, leaving the installation of the remainder to be determined by the demand for power.

Men of the Industry

Cox and Alexander Promoted

George H. Cox, for the past eight years New England district manager of the Westinghouse Electric & Manufacturing Company, with headquarters at Boston, has been appointed sales manager at the South Philadelphia works of the company. He will have charge of the marketing of all products manufactured at this plant, including steam turbines, condensers, Diesel engines, etc. Mr. Cox has won a high reputation in New England electrical circles for his co-operative activities in the interest of good trade relations, apart from his work as an engineering business executive.

G. H. Cox

James P. Alexander, manager of the New Haven branch office of the Westinghouse company, has been appointed New England district manager, succeeding Mr. Cox, with headquarters at Boston. Mr. Alexander was graduated in 1907 from Lafayette College with the degree of electrical engineer. Upon completing the Westinghouse apprentice course he entered the railway department of the company at East Pittsburgh and in 1911 was appointed railway engineer of the Boston office. He was assigned to the Springfield office in 1913 and in 1915 went to the New Haven office as railway and central-station salesman. In 1922 he was made manager of the transportation division at the Boston office and in 1924 became manager at New Haven.

J. P. ALEXANDER

H. H. Clark Vice-President of New Holding Company

Horace H. Clark, who has been connected with the People's Gas Light & Coke Company for almost 20 years, has severed his connection with that utility to become vice-president in charge of sales of the United Public Service Company, Chicago. Mr. Clark has had a wide experience in the public utility field, and for the past eleven years he has specialized in sales promotion work in its many phases.

Following graduation from the University of Missouri School of Mines in 1905, he worked in various capacities for the Laclede Gas Light Company of St. Louis in the electrical and gas operating departments. Since 1903 he has been affiliated with the Insull interests (Public Service Company of Northern Illinois, People's Gas Light & Coke Company and others) in several important posts. During the past few years he has also done consulting sales work for the Columbia Gas & Electric Company, the Illinois Power & Light Company, the United Light & Power Company and others.

E. D. Bell General Manager in Abilene

E. D. Bell of Champaign, Ill., has been appointed general manager of the United Power & Light Corporation with headquarters at Abilene, Kan. Mr. Bell succeeds C. A. Leland, Jr., who was recently promoted to the position of vice-president and general manager of the Iowa Power & Light Company at Des Moines. Mr. Bell has been in public utility work since 1908, when he started with the Illinois Traction System. Until 1924 he was division manager in charge of the electric lines operating out of St. Louis and also manager of the Madison County Power Company, which supplies power to the industrial districts in East St. Louis. From 1924 until the present Mr. Bell has been in charge of the Champaign-Urbana district of the Illinois Power & Light Corporation.

Samuel Insull, president of the Commonwealth Edison Company, Chicago, returned from Europe April 22 aboard the Cunard liner *Berengaria* after a short sojourn abroad.

Dean E. Ackers, local manager of the Kansas Power & Light Company at Topeka since Jan. 1, has been made assistant general manager of the company, according to an announcement made by A. M. Patten, vice-president and general manager of the Kansas properties of the North American Light & Power Company. The appointment is effective immediately. Mr. Ackers succeeds C. A. Leland, Jr., general manager of the United Power & Light Cor-

poration, Abilene, Kan., until his recent appointment as vice-president and general manager of the Iowa Power & Light Company and the Des Moines Electric Light Company. Mr. Ackers has been with the Kansas Power & Light organization since 1924. He is in charge of construction work at the Tecumseh plant, where extensive enlargement is being made.

Gordon to Lead New England Division, N.E.L.A.

Fred D. Gordon, who was elected president of the New England division of the National Electric Light Association at the annual meeting of that organization in Boston on April 26, is one of the best-known public utility operators in the Northeast. He was born at Readfield, Me., in 1876 and entered the electric light and power industry at the

F. D. GORDON

age of twenty. For fifteen years he was employed by the Androscoggin Electric Company, with headquarters at Lewiston, Me., during which period he rose to the post of general manager and built the electric interurban trolley line connecting Lewiston and Portland in association with the Libby interests. In 1921 he was appointed general manager of the Cumberland County Power & Light Company of Portland, succeeding A. H. Ford, and he has made a notable record in the public relations field in connection with this property. In the spring of 1926 he was elected president of the New England Street Railway Club.

John S. Boyett, until recently district manager of the Southwestern Light & Power Company at Lawton, Okla., has been appointed divisional superintendent in charge of the entire operations in southern Oklahoma and north Texas under Earl R. Ernsberger, president and general manager. The new appointment was made under a new plan of divisional operation inaugurated by the company. Mr. Boyett will have three assistants in this division, known as division A. They are R. W. Lindsey, Duncan manager; J. N. Hire, Altus manager, and L. K. McGee, manager of the Texas properties operated by the company. The two other divisions are: Division B: A. D. Kerr, new manager at Chickasha, in charge of the territory north of Chickasha and Cyril, Cement and Apache. Division C: H. H. Hatchett, Elk City manager, in charge of the northwest territory, including Elk City, Clinton, Weatherford and Sayre. R. A. Jackson, Hobart manager, is assistant in this division, with direct charge of Hobart, Lone Wolf, Granite, Gotebo, Mount View, Rocky, Sentinel, Roosevelt and Carnegie.

Guy E. Nickerson, merchandising manager of the Amesbury (Mass.) Electric Light Company, has been appointed manager of the company, succeeding the late Harland A. Sawyer.

A. F. Bedorf, superintendent of the McKeesport district of the Duquesne Light Company, has resigned to become general superintendent of the West Virginia Utilities Company at Morgantown, W. Va. Mr. Bedorf has been associated with the Duquesne utility at McKeesport since June, 1925.

Carl C. Giles, who for some time has been the president of the Porto Rico Railway, Light & Power Company and actively engaged in its management, has resigned. Mr. Giles designed the street cars now in service to meet tropical needs, and during the two years he has been in charge of the company many improvements have been brought about. He is now on his way to New York.

Ross L. McLellan, formerly managing director of the Westinghouse International Electric Company, has now been appointed general manager of the company to succeed D. K. Chadbourne. Mr. Chadbourne is severing his connection with the Westinghouse interests, after serving for two years as general manager of the Westinghouse International, to become vice-president of the Johnson Motor Company at South Bend, Ind.

Gaylord B. Buck, formerly manager of the electric sales department, Public Service Company of Colorado, Denver, has been appointed general new-business manager of the company's properties, with headquarters in Denver. He succeeds Charles A. Semrad, whose recent promotion to the position of vice-president and general manager of the St. Joseph (Mo.) Railway, Light, Heat & Power Company was announced in the April 9 issue of the ELECTRICAL WORLD. Mr. Buck has been associated with Doherty enterprises for a number of years. As general new-business manager he will supervise sales in the company's territory, reaching 142 communities in Colorado.

William B. Hartshorne, formerly service engineer in the electric department of the Public Service Electric & Gas Company, Newark, N. J., has been appointed assistant to the president of the Public Service Corporation of New Jersey. Mr. Hartshorne has been affiliated with the Public Service organization since 1908, when he became a cadet engineer. Upon completing the cadet course, he was made assistant to the Essex division superintendent of electric distribution; later he was assistant superintendent and then superintendent in the Bergen division, following that connection by becoming superintendent in the central division. In 1921 he was assigned to the general office in the Newark Terminal Building as service engineer.

J. H. Gill New President of Southeastern Division

Joe H. Gill, who was elected president of the Southeastern Geographic Division of the National Electric Light Association April 15, at the annual convention of the association at Memphis, is vice-president and general manager of the Florida Power & Light Company. Mr. Gill was born at Kerrville, Tex., in 1886 and was graduated from the University of Texas in 1910 with the degree of electrical engineer. After receiving his degree he joined the forces of the General Electric Company at Schenectady, N. Y., and remained with the company until 1912. Subsequently he allied himself with the Texas Power & Light Company of Dallas, where he first served as resident engineer in charge of transmission line and distribution line construction and later as supervisor of transmission lines in

J. H. GILL

entire charge of all construction of this character undertaken by the company.

Mr. Gill was with Stone & Webster from October, 1917, to April, 1918, as electrical engineer on design of the American ordnance base depot in France, and in April, 1918, he enlisted in the United States Army. When the World War was over he returned to Dallas, entering the employ of the Dallas Power & Light Company as power salesman on Feb. 1, 1919. While with this company he was successively power salesman, chief engineer and assistant general manager. Mr. Gill left the Dallas Power & Light Company early in 1925 at the time of the formation of the Florida Power & Light Company. When the organization of this company became complete Mr. Gill was made vice-president and general manager, the position he now holds. In 1923 he was president of the Southwestern Public Service Association.

Earle W. Gray, an electrical engineer who had been connected with the Westinghouse Electric & Manufacturing Company for a number of years, has recently been employed as assistant manager of the Southern Nebraska Power Company, with headquarters at Superior, Neb. He will also spend considerable time on promotion work for the purpose of extending the system by entering new towns and acquiring new power customers. Mr. Gray is a graduate of the electrical engineering

school of the Oklahoma Agricultural and Mechanical College. For the past five years he has been connected with the central-station division of the Westinghouse company at Kansas City.

William E. Mitchell, vice-president in charge of operations of the Alabama Power Company, a subsidiary of the Southeastern Power & Light Company, has been elected vice-president and general manager of the Georgia Power Company, another Southeastern subsidiary. Mr. Mitchell is succeeding W. H. Taylor, resigned, now vice-president in charge of operations of the United Gas Improvement Company.

C. A. Johnson, formerly connected with the Lowell (Mass.) Electric Light Corporation in the capacity of distribution engineer, has been transferred to the Gulf States Utilities Company, Beaumont, Tex., as assistant electrical engineer.

Obituary

Dr. Alfred H. Bucherer, well known physicist and professor of mathematical physics at Bonn University, Bonn, Germany, died April 16 after a short illness. Dr. Bucherer, who was 62 years of age, was of German and English descent. He came to this country in 1885 and after engaging in academic work he became a chemist with the Pittsburgh Reduction Company, now the Aluminum Company of America. Having invented a new process for the manufacture of aluminum, he affiliated himself with the Cowles Company. Subsequently he returned to Germany and accepted the chair of mathematical physics at Bonn University.

George Ross Green of Philadelphia died April 24 at the Germantown Hospital after a short illness. He was in charge of the station engineering department of the Philadelphia Electric Company for many years. He was born in Delaware and was graduated from the University of Pennsylvania in the mechanical engineering department. Mr. Green was the author of "American Meter Practice," out of which grew the "Metermen's Handbook," a national authority on meters in public utilities. He was one of the chief engineers of the Columbian Exposition in 1893 and was a member of the Franklin Institute, the A.I.E.E. and the Engineers' Club of Philadelphia.

William Goodman, inventor and vice-president of the Worthington Pump & Machinery Corporation, New York, in charge of manufacturing and engineering, died April 21 following an operation. Mr. Goodman was known for his development of the new two-cycle, double-acting Diesel engine and the development of the feather-valve air compressor. A native of Cincinnati and a graduate of Harvard, he entered the engineering department of the Laidlaw-Gunn-Gordon Company of Cincinnati, later absorbed by the Worthington unit. He became general manager of the Cincinnati plant and in 1918 was transferred to the New York office as assistant to the vice-president. He was elected a vice-president in 1922. Mr. Goodman was 53 years of age.

Recent Court Decisions

Electric Wiring and Fixtures as Part of Real Property.—The New York Court of Appeals held, in East New York Electric Company vs. Petmaland Realty Company, that one who furnished and installed electric wiring and fixtures upon real property under a contract that the title to the goods should vest in the vendor until fully paid for in cash, and which were attached to and became part of the real property and could not be detached without substantial injury to the building, could not be awarded a lien on the real property in the absence of stipulation by the parties. (243 N.Y.S. 477.)*

Company Held Liable for Lineman's Death Despite His Contributory Negligence.—In Sawyer vs. El Paso Electric Company damages were awarded for the death of a lineman who left an idle wire covered with insulation and uncharged hanging from a cut-out box on a pole when he should have removed it. The award has been affirmed by the Court of Civil Appeals of Texas, despite the fact that the jury answered in the affirmative a question as to the victim's contributory negligence. The company was found guilty of three negligent acts—inserting a plug in the cut-off box, thus electrifying wires near where the man was working on the pole; leaving an exposed live wire in the box, and maintaining a guy wire without a circuit breaker in contact with a live wire. Each of these acts of negligence, the court held, was a proximate cause of the lineman's death and rendered the company liable despite the deceased's own negligent action. His knowledge of the absence of a circuit breaker would be no defense for the company unless he was shown to know or have reason to believe that the guy wire was in contact with a live wire. (291 S.W. 667.)

Wisconsin Commission Cannot Arbitrarily Refuse All Authority to Issue Securities.—According to a precedent-setting decision of the Wisconsin Supreme Court, the Wisconsin Railroad Commission exceeded its statutory powers when it denied the application of the Central Steam Heat & Power Company for authority to issue securities, on the grounds that the projects could not be financially successful, that the amount of securities asked would exceed the value of the property, that the securities would not be a safe invesment, that the proposed expenditures were excessive and that the amount of the proposed securities exceeds the amount reasonably necessary therefor. Instead of denying the application, the court held that the commission should have complied with the statutes and determined the reasonable amount of the securities that could be issued. It has therefore remanded the case to the commission, with instructions to find and determine the amount of common stock, preferred stocks and bonds reasonably necessary and, having made such findings, to issue a certificate of authority accordingly, in conformity with the statute. The company applied for authority to issue $50,000 common stock, $70,000 preferred and $180,000 bonds upon two central heating plants to be erected at Port Washington and Plymouth.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Customers Cannot Take Advantage of Meter Readers' Mistakes.—Customers of public utilities in Kansas cannot escape paying for service because of mistakes of the company's meter readers. The Kansas Supreme Court has held that a public utility which fails to bill a patron for the full amount he owes it cannot be barred by the statute of limitations from collecting the balance due when the mistake is discovered. The question arose because meter readers for the Kansas Electric Power Company at Emporia did not know they should multiply by ten the figure recorded by the meter registering consumption of energy by W. L. Thomas's candy factory at Emporia, a very large part of the energy thus failing to be charged.

Commission Rulings

Competition Permitted in North Dakota.—The electric utility company operating in Belfield, N. D., tried to exclude the Hughes Electric Company from the community by soliciting commission disapproval of the rates proposed. The commission, however, held that it had no jurisdiction over the question of competition between public utilities and that if the proposed rates appeared to be reasonable, they must be approved. Notwithstanding this decision, which was based upon the fact that powers had never been granted the commission to regulate competition, that body expressed its disapproval of competition between public utilities.

Discretion of Commission in Sanctioning Extension of Municipal Service.—In accordance with an opinion by the Attorney-General of the state, the Indiana Public Service Commission finds that under existing laws a municipality may build transmission lines connecting its plant with another city or town and provide service to the neighboring city. This question arose in a case where the town of Thorntown proposed to abandon its electric plant and the city of Frankfort proposed to provide service to Thorntown from the Frankfort municipal plant. If sound discretion under all the facts warrants such an enterprise, the Attorney-General advised the commission, it has complete sanction of the law. He added that if such discretion would operate to withhold such an undertaking, the enterprise could not be sanctioned lawfully. Under the law, he said, the enterprise is conditional on the consent of the Public Service Commission.

Financial and Statistical

Utility Stocks Decline Least
Averages Slightly Lower
Brokers' Loans Increase

A WEEK of hectic trading has carried security price averages lower than for some time, but utility stocks, as usual, declined less than industrials and other groups. However, the market acted as a unit more than is normally the case. Favorable dividend and earnings reports concerning some of the leaders had been discounted, and, as has so often happened of late, the publication of anticipated favorable news has been the signal for a selling movement.

There is a difference of opinion as to what will be the probable action of the Federal Reserve Bank of New York with regard to the money rate. It is argued that the rate will not be changed while brokers' loans continue to increase so rapidly lest it should be a further incentive to speculation. Such loans have increased by almost $175,000,000 in the last six weeks. On the other hand, the action of the Bank of England in lowering its rate to 4½ seems likely to effect a similar reduction in the English rate on foreign deposits. This would drive funds from London to New York, thus encouraging speculation here in precisely the same manner as a lowering of the money rate would. As a result of this dilemma very careful attention is being paid to the situation.

As intimated above, utility stocks declined only moderately in the week's selling movement and have largely recovered their losses. Electric Power & Light and American Water Works & Electric are typical of the stocks which sold off with the market but recovered promptly. Brooklyn Edison and Consolidated Gas, Electric Light & Power of Baltimore were among the strong issues. On the whole, few net gains for the week are recorded.

In over-the-counter trading advances were more general in the utility group than elsewhere. Gains were made by Southern Cities Utilities, Oklahoma Gas & Electric and North Carolina Public Service.

February Revenue Shows 9 Per Cent Gain

Income of $147,600,000 and Energy Output of More than 5,700,000,000 Kw.-Hr.—Large Sales for Resale a Feature of Record for Month

AN ENERGY output of 5,711,993,000 kw.-hr., a revenue of $147,600,000, operating expenses of $59,700,000 and sale for resale of 1,180,000,000 kw.-hr. are indicated as the chief features of February operations in the electric light and power industry, according to reports received thus far by the ELECTRICAL WORLD in its monthly survey of the industry. It is apparent from the returns that the more than normal rate of increase which has prevailed since the fall of 1925 is gradually running its course, and that more moderate progress on the high level thus attained is now taking place. This is shown both in the energy output and in the revenue, when comparisons are made for successive months with the corresponding months a year before.

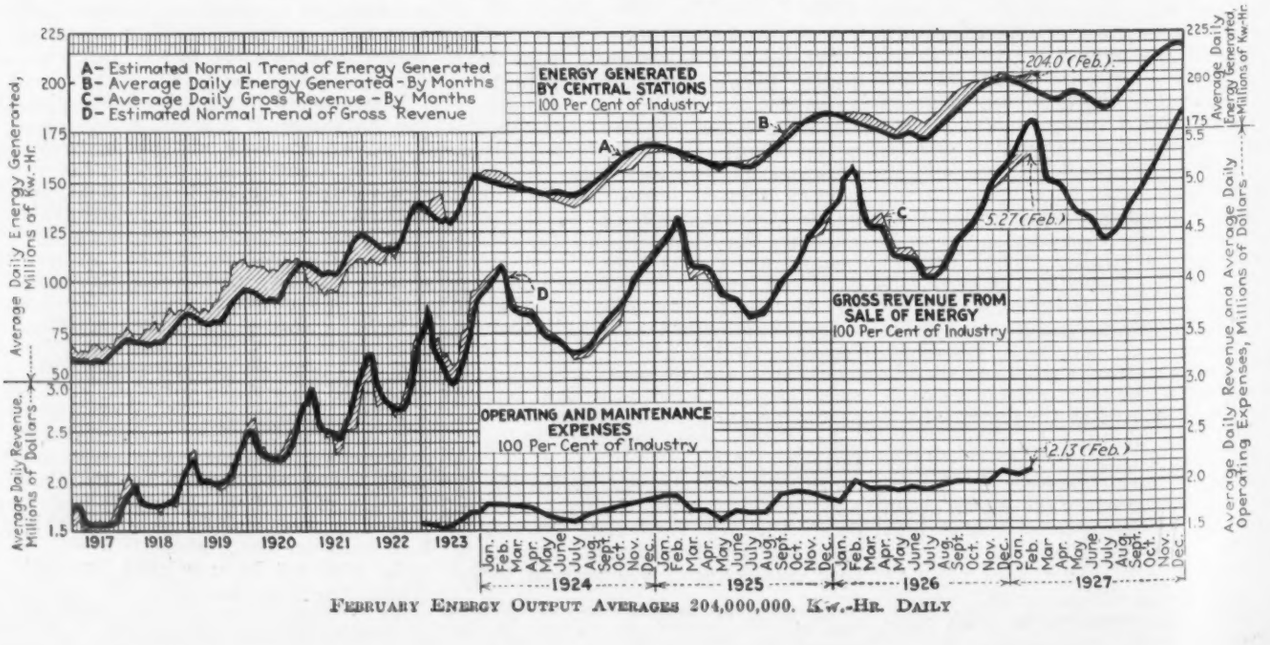
TABLE I—OPERATING RATIO OF CENTRAL-STATION COMPANIES

	Operating Ratio					
	Steam Plants		Hydro Plants		Combined Hydro and Steam Plants	
	1926	1925	1926	1925	1926	1925
Nov.	44.5	44.3	34.5	33.5	41.9	42.8
Dec.	43.4	45.5	36.7	35.5	40.8	42.6
	1927	1926	1927	1926	1927	1926
Jan.	40.6	40.6	33.3	31.8	39.2	40.4
Feb.	42.7	42.2	37.4	36.5	39.6	40.8

Beginning with November, the rate of growth in energy generated has decreased slightly in each succeeding month: 12.4 per cent, 11.6, 10.9 and 10 per cent, the last being the figure for February. The revenue has necessarily shown a similar tendency, the percentages being 11.5, 12.6, 10.9 and 9.1. There are indications that the February figure will increase slightly in the final revision when late returns are included.

SOUTH LEADS IN ACTIVITY

Of the increase in energy output a more than proportionate share came from water power, the growth for hydro-electric plants being about 16 per cent, whereas the energy generated from fuel was only 5 per cent greater than in February of 1926. The greatest progress appears to have been made in the South Atlantic and West South Central States, with gains for the year of 16 and 29 per cent respectively. In the Pacific States the gain was 11 per cent. Moreover, in these three regions the February gains are higher than those for January, whereas all other parts of the country show a smaller gain. The state showing the highest rate of increase was North Carolina, 75 per cent. A portion of this remarkable advance is due to a rela-


A- Estimated Normal Trend of Energy Generated
B- Average Daily Energy Generated - By Months
C- Average Daily Gross Revenue - By Months
D- Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
204.0 (Feb.)
5.27 (Feb.)
2.13 (Feb.)
Average Daily Energy Generated, Millions of Kw.-Hr.
Average Daily Revenue, Millions of Dollars
Average Daily Energy Generated, Millions of Kw.-Hr.
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
1917 1918 1919 1920 1921 1922 1923
1924 1925 1926 1927

FEBRUARY ENERGY OUTPUT AVERAGES 204,000,000 KW.-HR. DAILY

TABLE I—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL PLANTS IN THE UNITED STATES*
(100 Per Cent of the Industry)

Month	Energy Generated: Hydro-Plants 1926 Thousands of Kw.-Hr.	Hydro-Plants 1925 Thousands of Kw.-Hr.	Hydro-Plants Per Cent Increase	Fuel Power Plants 1926 Thousands of Kw.-Hr.	Fuel Power Plants 1925 Thousands of Kw.-Hr.	Fuel Power Plants Per Cent Increase	Fuel Consumption: Coal 1926 Short Tons	Coal 1925 Short Tons	Coal Per Cent Increase	Oil 1926 Barrels	Oil 1925 Barrels	Oil Per Cent Increase	Gas 1926 Thousands of Cubic Feet	Gas 1925 Thousands of Cubic Feet	Gas Per Cent Increase
November	2,193,093	1,915,694	+14.4	3,870,691	3,476,163	+11.3	3,193,212	3,062,335	+ 4.2	926,916	744,011	+24.5	3,975,408	4,182,000	— 4.9
December	2,377,175	1,946,949	+22.1	3,998,325	3,767,118	+ 6.1	3,406,140	3,350,689	+ 1.6	769,518	761,140	+ 1.1	3,685,611	3,671,437	+ .3
	1927	1926		1927	1926		1927	1926		1927	1926		1927	1926	
January...	2,341,659	1,928,775	+21.4	3,960,380	3,754,280	+ 5.5	3,362,628	3,272,761	+ 2.7	778,594	972,131	—19.9	3,772,700	3,661,363	+ 3.0
February..	2,181,188	1,886,471	+15.6	3,530,805	3,304,174	+ 6.8	2,969,052	2,886,534	+ 2.8	645,024	683,580	— 5.6	3,768,197	3,328,365	+13.2

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

tive slump in that state in February, 1926, whereby the contrast is exaggerated. There was, however, an actual gain even over the January output—an unusual condition for the shortest month in the calendar.

Despite the increase in energy output from fuel for the country as a whole, there was a decrease in the consumption of coal and of fuel oil, which was not counterbalanced by the moderate increase in the consumption of natural gas. Evidently the improvement in the utilization of fuel, on which comment has several times been made in these monthly reviews of the industry, continues unabated.

Segregation of the energy consumption according to use indicates that the industrial load has held to a daily average very close to 100,000,000 kw.-hr., with surprising steadiness, at least since last October. Though the attempt to make such an allocation is subject to some slight uncertainties, the up and down swings in exact stride with the varying lengths of the months can scarcely be a coincidence. Apparently there has been no recession, nor, on the other hand, has there been appreciable growth.

Regional Changes in Earnings

Regional conditions are also reflected by the reports of earnings. In New England a group of companies having a combined revenue of about $80,000,000 per year reported February earnings nearly 8 per cent greater than in February, 1926, and average daily receipts about 2 per cent in excess of those for January. In the Atlantic States the year's gain exceeded 11 per cent, according to the combined figures of companies constituting over a sixth of the whole light and power industry in the country. Similar comparisons for other sections indicate a gain in the North Central States of 7.5 per cent and in the Western States of nearly 11 per cent. An apparent gain in the South Central States of more than 20 per cent is to be ascribed to consolidations, whereby the returns of several companies for 1927 are rendered uncomparable with those for 1926. When those returns are eliminated a growth of 14 per cent is indicated, probably fairly reflecting present conditions in the Central South and Southwest. On the whole, the analysis indicates a continuation of the regional conditions discussed in connection with the presentation of returns for January, except that the percentages are in general slightly lower.

Fifteen-Million-Dollar Offer Made by Brooklyn Edison

The Brooklyn Edison Company has announced that $15,000,000 of the $25,000,000 of capital stock recently authorized would be offered at par to shareholders at the rate of one share of the new issue for every five held. Stockholders of record May 11 may subscribe under the offer, which will expire June 1.

TABLE II—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 Per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly * 1926 Thousands	1925 Thousands	Per Cent Inc.	Estimated Distribution of Energy Generated: Total Energy Consumption by Central-Station Customers, Kw.-Hr. 1926 Thousands	1925 Thousands	Energy Consumed for Lighting, Kw.-Hr. 1926 Thousands	1925 Thousands	Energy Consumed for Power, Kw.-Hr. 1926 Thousands	1925 Thousands	Energy Sold to Electric Railways, Kw.-Hr. 1926 Thousands	1925 Thousands	Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr. 1926 Thousands	1925 Thousands	Energy Purchased by Public Utilities for Resale, Kw.-Hr. 1926 Thousands	1925 Thousands
Nov....	6,063,784	5,391,857	+12.4	4,933,784	4,349,857	1,310,000	1,202,000	3,073,784	2,615,857	550,000	532,000	1,130,000	1,042,000	1,195,000	996,000
Dec....	6,375,500	5,714,067	+11.6	5,195,500	4,611,067	1,400,000	1,258,000	3,195,500	2,803,067	600,000	550,000	1,180,000	1,103,000	1,182,000	1,020,000
	1927	1926		1927	1926	1927	1926	1927	1926	1927	1926	1927	1926	1927	1926
Jan.....	6,302,039	5,683,055	+10.9	5,177,039	4,586,055	1,450,000	1,260,000	3,104,039	2,771,055	623,000	555,000	1,125,000	1,097,000	1,218,000	1,010,000
Feb.....	5,711,993	5,190,645	+10.0	4,701,993	4,188,645	1,325,000	1,128,000	2,818,993	2,559,645	558,000	501,000	1,010,000	1,002,000	1,180,000	950,000

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

TABLE III—CENTRAL-STATION FINANCIAL OPERATIONS FOR FOUR MONTHS IN THE UNITED STATES
(100 Per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy† 1926 Thousands	1925 Thousands	Per Cent Inc.	Estimated distribution of Gross Revenue: Lighting Customers 1926 Thousands	1925 Thousands	Power Customers 1926 Thousands	1925 Thousands	Electric Railways 1926 Thousands	1925 Thousands	Other Public Utilities 1926 Thousands	1925 Thousands	Total Operating and Maintenance Expenses‡ 1926 Thousands	1925 Thousands
November	$148,000	$132,800	+11.5	$90,500	$87,700	$41,900	$32,600	$4,900	$4,400	$10,700	$8,100	$61,000	$54,800
December	154,700	137,400	+12.6	95,200	89,700	43,500	34,400	5,400	4,600	10,600	8,700	63,200	57,800
	1927	1926		1927	1926	1927	1926	1927	1926	1927	1926	1927	1926
January .	161,200	145,300	+10.9	101,600	92,400	42,800	38,500	5,700	5,300	11,100	9,100	62,600	57,900
February	147,600	135,300	+ 9.1	92,800	84,000	38,900	37,300	5,100	4,800	10,800	9,200	59,700	54,300

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund.

Power Companies Yield Under 8 Per Cent

Federal Trade Commission's Report on Electric Power Industry Shows Operating Units of Large Power Interests Yield Less than Smaller Companies

CRITICS of the light and power industry who demand more government regulation and who believe the present rate of return to investors unduly high find little support in the recently issued report of the Federal Trade Commission on the electric power industry. The report is based on statistics covering about 80 per cent of the industry and is therefore representative. A study of those sections dealing with yield on invested capital shows that in 1924 the average yield was 7.94 per cent on total investment and 7.83 per cent on estimated electrical investment.

A rather unexpected feature of the commission's report is that operating companies of the large power interests realized slightly lower average rates of return both on total investment and on estimated electrical investment than the smaller companies. The rates of return for all privately owned and operating companies returning schedules that could be depended upon, grouped according to company affiliations for 1924, as given in the Trade Commission Report, are as follows:

	Rates of Return on	
General Electric: Electric Bond & Share Co.	Total Investment	Estimated Electrical Investment
Supervised	8.09	7.65
Not supervised	5.35	5.61
Total	7.55	7.27
Other General Electric	7.66	7.48
Total General Electric	7.57	7.32
Other holding companies	8.05	7.95
Total holding companies	7.95	7.77
Large independent companies	7.96	7.44
All other independent companies	8.06	9.16
Total independent companies	8.00	8.00
Total privately owned, reporting	7.94	7.83

The yield on holding company stock is naturally higher than these averages. Under current methods of financing much of the investment of operating companies is obviously represented by bonds bearing interest and preferred stock bearing dividend rates lower than the average rate realized on the total investment of the companies. For this reason the rate of earnings accruing to the remaining common stock equities owned by the holding companies is considerably in excess of 8 per cent, being frequently as high as 12 or 15 per cent and sometimes much higher. This fact has attracted capital and has made possible rapid expansion and continual improvements in service. Earnings of the holding companies, both on total investments and on stockholders' equities, tend to magnify the earnings of the operating company, especially where there has been a pyramiding of several successive holding companies. Moreover, the same general plan of financing extensively with low-rate bonds and preferred stock is adopted by the holding companies, leaving still larger earnings for the common stock equity which assumes the risk of fluctuation in earnings from year to year. The number of companies reporting deficits in the past shows that there has been a decided element of risk. From the published statement of several of the holding companies studied, illustrations in the following table prepared by the Federal Trade Commission show the

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday April 26	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	90½	83	94
Adirondack Pwr. & Lt.—7% pf.	109	107	109½
Adirondack Pwr. & Lt.—8% pf.	114	112	114
Ala. Pwr., 7% pf.	111	107	112½
Allis-Chalmers Mfg., 7% pf.	k112½	109	112½
Allis-Chalmers Mfg., 6% com.	104	88	107
Aluminum Co. of Amer., com.	69	68	73
Aluminum Co. of Amer., 6% of	103	101½	104½
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	97	86½	99
Amer. & Foreign Pwr., com.—no par.	22½	18½	25½
Amer. Bosch Magneto, com.—no par	16	13	18½
Amer. Brown Boveri Elec†	23½	21	39½
Amer. Brown Boveri Elec., pf. $7	84½	84½	98
Amer. Gas & Elec., 6% pf.—no par	101	95½	101
Amer. Gas & Elec., com.†—no par	80½	68½	100½
Amer. Lt. & Trac., 6% pf.	116	112	120
Amer. Lt. & Trac., com.†	242	222	259
Amer. Pwr. & Lt., 6% pf.	102	97½	103½
Amer. Pwr. & Lt., com.†—no par	61	54	64½
Amer. Pub. Serv., 7% pf.	k 98	95	99½
Amer. Pub. Serv., com.†	50	....	....
Amer. Pub. Utilities,6 % pr. pf.	92	88	93
Amer. Pub. Utilities, 7% pfc. pf.	85	73	82
Amer. Pub. Utilities,com	55	65	70
Amer. States Sec., A	3½	3½	4½
Amer. States Sec., B	3½	3	4½
Amer.Superpwr.,$6 pf.—25	28	26½	28½
Amer. Superpwr., 7% pf.	l 96½	....	....
Amer Superpwr., Class A†—no par.	32½	27½	33½
Amer.Superpwr., Class B†—no par.	33½	28½	34½
Amer. Wtr. Wks. & Elec., 7% pf.	k109½	104½	110½
Amer. W. W. & E., com. $1.20—20.	80½	62½	81½
Anaconda Copper cap. $3	47	45	49½
AppalachianElectric Pwr., 7% 1st pf.	102	100	104
AppalachianElec. Pwr., 2d pf., 7%	100	100	102
Appalachian Elec. Pwr.,com	m78	....	....
Arizona Pwr.,7% pf.	79	77	84½
Arizona Pwr., com.	34½	22	34½
Arkansas Cent. Pwr., pf.—$7 no par.	k102	101	103
Arkansas Lt. & Pwr., 7% pf.	103½	101	104
Arkansas Lt. & Pwr., com.	100	....	....
Assoc.Gas & Elec., $3.50—50	53	....	....
Assoc. Gas & Elec., pf.—$6—no par.	91	85	90
Assoc. G.&E., Class A, $2.50—no par	40½	35	42
BABCOCK & WILCOX, 7% com.	119	115	123
Binghamton L., H. & P., $6 pf.	93	93	95
Birmingham Elec., pf.—$7—no par.	108	105	109
Blackstone Valley G. & E., $6 pf.	103	103	105
Blackstone Valley Gas & Elec., 10% com.—50	130½	98	130½
Blaw-Knox, com.†	f 72	70	73
Brazilian Trac., Lt. & pwr., com.†	f140½	....	....
Broad River Pwr., 7% pf.	100	97	100
Brooklyn Edison, 8% com.	157½	148½	159½
Buffalo, Niagara & East. Pwr.,pf.—25	f 25½	....	....
Buffalo, Niagara & East. Pwr. com.† —no par	f 29½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	97	96	98
California Ry. & Pwr., 7% pf.	135	125	150
Carolina Pwr. & Lt., pf.—$7—no par	f108½	107	108½
Central & S.W. Util., 7% pf.—no par	a 97	93½	97½
Central & S. W. Util., pr. ln. $7 pf. —no par	a103	98½	102½
Central Ariz. Lt. & Pwr., 7% pf.	f100	100	100
Central Ark. Ry. & Lt., 7% pf.	101	100	102
Central Ill. Pub. Serv., 6% pf.	a90	88½	95½
Central Ind. Pwr., 7% pf.	89	86	90
Central Pwr. & Lt., 7% pf.	101	100½	103
Central States Elec., 7% pf.	94	93	96
Central States Elec., com.†	m200	....	....
Century Elec., 6% com.	m115	115	115
Chicago Fuse Mfg., com.—$2.50 no par	a 33½	30	34½
Cincinnati Gas & Elec., 5% com.	a 96½	93½	97½
Cities Service, 6% pf.	k 89½	88½	92½
Cities Service, pf. B—10 ex. div.	l 8½	8	8½
Cities Service, pf. BB—100	82	80½	85
Cities Service, com.—20	l 46½	40½	58½
Cities Service, Bks. Shrs.—10	l 23½	24	29½
Clarion River Pwr., 8% pf.	95	....	....
Cleveland Elec. Illg., 6% pf.	108	108	109½
Cleveland Elec. Illg., 10% com.	295	302	310
Colorado Pwr., 7% pf.	k 95	95	97½
Columbia Gas & Elec., 6% pf.	104½	99½	105½
Columbia G. & E. com. $5—no par.	92½	82½	96½
Columbia Ry., Gas & Elec., 6% pf.	94	....	....
Columbus Elec. & Pwr., 2d. pf.	108	....	....
Columbus Elec. & Pwr., 9% com.	64½	....	....
Columbus Ry., Pwr. & Lt., 6%, 1st pf.	100	98½	99½
Columbus Ry., Pwr. & Lt., 6½% pf. B	101	96	99
Columbus Ry., P. & L., com.—no par	k 80	75	79
Commonwealth Edison, 8% com.	a143	138	145
Commonwealth Pwr., 6% pf.	97½	91½	97½
Commonw'th Pwr., $2, com.—no par	46½	42½	48
Conn. Lt. & Pwr., 8% pf.	120	119	123
Conn. Lt. & Pwr., 7% pf.	113	112	113½
Cons. Gas of N. Y., pf.†—50	56	55½	62½
Cons. Gas of N. Y., com.$5—no par.	99½	94	109½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	k105	105	107
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	a111	111	112½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	a114	112½	115½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	a127½	126	129
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par.	a 54½	51	56
Consolidated Pwr.& Lt., 7% pf.	101	100	103
Consumers Pwr., 6% pf.	102	100	102
Consumers Pwr., 6.6% pf.	105	103	105½
Continental Gas & Elec., 8% pfc. pf.	106½	103	106½
Continental Gas & Elec., 7% pr. pf.	103	100	103
Conti. G. & E. com. $4.40—no par.	k220	210	225
Crocker Wheeler, com.†	31	30	38
Crocker Wheeler, 7% pf.	83	78	88
DALLAS PWR. & LT., 7% pf.	107	107	109½
Dayton Pwr. & Lt., 6% pf.	103	101	103
Detroit Edison, 8% com.	140½	133½	143½
Dubilier Condenser, com.—no par.	4½	3½	5½
Duquesne Lt., 7% pf.	k115½	114½	116½
EASTERN NEW YORK UTIL., $7 pf.	103	102	104½
Eastern New York Util. com.	65	70	75
Eastern States Pwr., $7, com.	10	11	13
Eastern States Pwr., pf.	90	93	95
East. Tex. Elec., 7% pf.	106	106	108
East. Tex. Elec., com. $5—no par.	90	....	....
Edison Elec. of Boston, 12% com.	d245	217½	253
El Paso Elec., com. $5—no par.	70	....	....
El Paso Elec., 7% pf.	108	105	107½
Elec. Bond & Share, 6% pf.	l106½	105½	109
Elec. Bd. & Sh. Sec.,com. $1—no par	l 70½	67½	72½
Electric Household Util.†	a 12	11	14½
Elec. Investors, 6% pf.—no par.	93	92	94
Elec. Investors, com.†—no par.	38	32½	40½
Elec. Investors, 10% pd. receipts	m 15	....	....
Elec. Pwr. & Lt., ctfs. pf.	k102½	96	103
Elec. Pwr. & Lt., ctfs., 40% pd.	110½	103½	112½
Elec. Pwr.& Lt., ctfs. full pd.	k111	108½	111½
Elec. Pwr. & Lt., ctfs., com.—no par.	20½	16½	20½
Elec.Refrig. cap.†	24½	22½	37½
Elec. Ry. Securities, com.—no par.	k 7½	6	8
Elec. St. Battery com. $5.25—no par	66½	65½	70½
Elmira Wtr., Lt. &R.R., 7% pf.	101	99	101½
Emerson Elec., pf.	m105	....	....
Empire Pwr., A $6	34	....	....
Engr. Pub. Serv., $7 pf.—no par.	103	93½	103
Engr. Pub. Serv., com.—no par	24½	21½	25½
Eureka Vacuum Cleaner, com. $4—no par	70	60½	72½
FAIRBANKS MORSE, 7% pf.	k110½	107½	112
F.-M., com.—$2.60—no par.	k 40½	38½	42½
Federal Lt. & Trac.,com.†	42½	37½	44½
Federal Lt. & Trac., 6% pf.	97½	91½	99½
Ft. Worth Pwr. & Lt., 7% pf.	k110	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	72	68	72
Galveston-Houston Elec., com.	26	28	30
Gen. Elec., 8% com.	97½	81	99½
Gen. Elec., special—10	11½	11½	11½
Gen. Gas & Elec. (Del.) com. A. $1.50—no par	30½	34	47½
Gen. G.&E. (Del.) com. B—no par.	m39	35½	43½
Gen. G.&E. (Del.) pf. A. $8—no par.	k114	113½	115½
Gen. G.&E. (Del.) pf. A $7—no par.	k102½	100	107½
Gen G.& E. (Del.) pf. B $7	k100	96	100½
Gen. Pub. Serv., $7 pf.	k107½	105½	108
Gen. Pub. Serv., com.	13½	11½	14½
Ga. Lt., Pwr. & Rys., 6% pf.	91	87	92
Ga. Lt., Pwr., & Rys., com.	m 60	....	....
Ga. Ry. & Pwr., 8% pf.	k123	119	123
Ga. Ry. & Pwr., 7% pf.	112½	106	110
Ga. Ry. & Pwr., 4% pf.	m119	....	....
Ga. Ry. & Pwr.,4% com.	120	....	....
Gt. Western.Pwr.,7% pf.	h102½	....	....
IDAHO PWR., 7% pf.	106	103	105
Ill. No. Utilities, 6% pf.	a 95	88	92
Ill. Pwr. & Lt., 7% pf.	100	99	101
Ingersoll Rand com. $8	k93	92	96½
Int. Combus. Engr., com. $2—no par	54½	43½	64
Int. Util., Class A—$3.50—no par.	k34	28	36
Int. Utilities, Class B—no par.	k 4½	3	5½
Interstate Pwr., pf.—$7—no par.	94	93	97
Interstate Pub. Serv., 7% pf.	99½	98	99½
Iowa Ry. & Lt., 7% pf.	98	97	99
JERSEY CENTRAL PWR. & LT., 7% pf.	102	100	102½
Jersey Cent. Pwr. & Lt., 7% pfc. pf.	115	111	115
Jersey Cen. Pwr. & Lt., com.—no par	k 25	....	....
Johns-Manville, com.†—no par.	66½	55½	73½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, April 23. lBid price Wednesday, April 27. mLatest quotations available. †Dividend rate available.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday April 26	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	115	112	115
Kansas Gas & Elec., 7% pf.	/106	103	104
Kentucky Hydro-Elec., 7% pf.	a 96½	94½	97½
Kentucky Sec.,6% pf.	86	83	87
Kentucky Sec., 5% com.	109½	110	115
Kentucky Utilities, 6% pf.	98	95	96½
Keystone Pwr. & Lt., 7% pf.	97	96½	99
LACLEDE GAS LT., 8% com.	k191	173½	198½
Lehigh Pwr. Sec., com.—no par.	18½	15	20
Long Island Ltg., 7% pf.	109½	107	109
Long Island Ltg., com. $2—no par.	144	139	153
Los Angeles Gas & Elec., 6% pf.	99	98	100½
Louisville Gas & Elec., cl. A. $1.75	26½	23½	27½
MAN. ELEC. SUPPLY, cap. $4.25—no par	69½	53½	72
Manila Elec., com.†—no par.	k 44½	40	46
Maytag Mfg., com. .50—no par.	29	23½	30½
Memphis P. & L., pf.—$7—no par	108½	107	109
Metropolitan Ed., pf.—$6—no par.	98	93	97
Metropolitan Ed., pf.—$7—no par.	106	104	108
Metropolitan Ed., com. $5—no par.	67	....	....
Middle West Utilities, 7% pf.	a107½	105½	113½
Middle West Util., 7% pr. lien pf.	a118	117½	120
Middle West Util., com. $6—no par	a110½	108	114½
Midland Utilities, pr. in. 7% pf.	a102	98	102½
Midland Utilities, 7% pf. A	a 98	96½	99½
Milwaukee Elec. Ry. & Lt., 7% pf.	k101	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k99	98	101
Minn. Pwr. & Lt., 7% pf.	/106½	104	105
Miss. Pwr. & Lt., $8 pf.	110	106	111
Miss. River Pwr., 6% pf.	98	94	97
Miss. River Pwr., com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	106	100	104
Mohawk Hudson Pwr., 2d pf.—$7—no par	103	98	101½
Mohawk Hudson Pwr., com.—no par	24½	20½	27
Montana Pwr., 7% pf.	m123	118½	123
Montana Pwr., 5% com.	96½	81½	100
Montreal Pwr., 7% com.	f 82½	....	....
Mountain States Pwr., 7% pf.	100	97	101
Mountain States pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	107	98	105
National Carbon, 8% pf.	a135	130½	137½
National Elec. Pwr., A†	a 24½	23½	25½
National Elec. Pwr., 7% pf.	k 97	94	98½
National Lt., Ht. & Pwr., com.	24	....	....
National, Light, Ht. & Pwr., 5% pf.	70	....	....
National Pwr. & Lt., pf.—$7—no par	106½	101	107½
National Pwr. & Lt., com.†—no par.	22½	19½	23½
National Pub. Serv., 7% pf.	k 96½	93	96
National Pub. Serv., 7% ptc., pf.	113	108	115
National Pub. Serv., A com. $1.60—no par	21½	18½	22½
National Pub. Serv., B com.—no par	18½	14	20½
Nebraska Pwr., 7% pf.	/109	106	109
Nevada-Calif. Elec., com.	m31½	25	31
New Brunswick Pwr., 7% pf.	55	....	....
New Eng. Pub. Serv., pr. in. pf. $7	101	98½	101
New Eng. Pub. Serv., pf. $7	97	95	97
N. J. Pwr. & Lt., 6% pf.	93	....	....
New Orleans Pub. Serv.—7% pf.	106	103	105
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	....	....
N. Y. Central Elec., 7% pf.	102	102	104
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	....	....
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	....	....
Niagara Falls Pwr., 7% pf.—25.	k 28½	27½	29
Niagara, Lock. & Ont. Pwr., 7% pf.	111	110½	113
No. Amer., 6% pf.—50.	51½	50	52
No. Amer., com.—10.	47½	45½	50½
No. Amer. Edison, $6 pf.—no par.	k100½	96½	101½
No. Caro. Pub. Serv., pf.—$7—no par	98	93	97
Northeastern Pwr., com.	15½	15	18½
No. Indiana Gas & Elec., 7% pf. A.	103	102	104
No. N. Y. Utilities, 7% pf.	105	103	105½
No. Ohio Pwr., com.—no par.	10½	9½	13½
No. Ohio Trac. & Lt., 6% pf.	80	78	81
No. Ohio Trac. & Lt., 7% pf.	90	90	93
No. Ont. Lt. & Pwr., 6% pf.	k 90	84	90
No. Ont. Lt. & Pwr., 4% com.	74	73	78
No. States Pwr., (Del.) 7% pf.	104	101	104
No. States Pwr., 8% com.	115	109½	118
No. Texas Elec., 6% pf.	71	65	70
No. Texas Elec., 4% com.	30	27	36
OHIO BRASS, com. B $4—no par.	80	74	85
Ohio Brass, 6% pf.	102	100	103
Ohio Gas & Elec., 7% pf.	100	95	97
Ohio Pwr., 6% pf.	100½	96	99
Ohio Pub. Serv., 6% pf.	k 95	95	96½
Ohio Pub. Serv., 7% pf.	107	103	105½
Ohio River Edison, 7% pf.	107	103	105½
Oklahoma Gas & Elec., pf.	98	....	....
PACIFIC GAS & ELEC., 6% pf.	25½	24½	26½
Pacific Gas & Elec., 8% new com.	33½	31	33½
Pacific Pwr. & Lt., 7% pf.	/103	102	104
Parr Shoals Pwr., 6% pf.	92	....	....
Penn Cent. Lt. & Pwr., $5 pf.—no par.	c 74½	71½	75
Penn-Ohio Edison, 7% pf.	101½	97½	101½
Penn-Ohio Elec., 7% pf.	100	98	100
Penn-Ohio Pwr. & Lt., 7% pf.	101½	99	102
Penn-Ohio Pwr. & Lt., 8% pf.	111	109	112
Penn Pwr.& Lt.—$7—no par.	/109	107	108½
Penn. Pub. Serv., 6% pf.	87	....	....
Penn Wtr. & Pwr., 8% com.	a190	176	190
Phila. Co., 6% pf.—50.	k 52½	50	53
Phila. Co., com.—50.	k103	85½	110
Phila. Elec., 8% com.—25.	c 48	46½	54
Portland Elec. Pwr., 7% pf.	75	....	....
Portland Elec. Pwr., 6% pf.	k 77	....	....
Portland Elec. Pwr., 6% 2d pf.	55	....	....
Portland Elec. Pwr., com.	22	28	30
Potomac Elec. Pwr., pf.	/108½	....	....
Pwr. Corp. of N. Y., com. $1—no par	m 79	....	....
Pwr. Sec., pf.—no par.	k 28	28	33
Pwr. Sec., com.—no par.	k 6	5	8
Public Serv. of Colorado, 7% pf.	97	....	....
Pub. Serv. of N. J., 7% pf.	113½	....	....
Pub. Serv. of N. J., 6% pf.	100½	98½	101
P. S. of N. J., $5 com.—no par.	38	32	39½
Pub. Serv. of No. Ill., 6% pf.	a105	102	105
Pub. Serv. of No. Ill., 7% pf.	a112½	112½	116½
P. S. of No. Ill., com. $8—no par.	a133½	130½	142
Pub. Serv. of No. Ill., 8% com.	k133	130	135
Pub. Serv. of Okla., 7% pf.	/100	99	100
Pub. Serv. Elec. & Gas, 6% pf.	107½	102	107½
Pub. Serv. Elec. Pwr., 7% pf.	k114½	113½	116½
Puget Sound Pwr. & Lt., 7% pf.	107	105	107
Puget Sound Pwr. & Lt., 6% pf.	86	....	....
Puget Sound Pwr. & Lt., com.	28½	....	....
RADIO CORP. OF AMER., pf.—50.	50	49½	53
Radio Corp. of Amer., com.—no par.	44½	41½	56½
Republic Ry. & Lt., pf.	k120	....	....
Republic Ry. & Lt., com.	k122	112	135
Rochester Gas & Elec. 6% pf.D.	k102	101	103½
Rochester Gas & Elec., 6% pf. C.	103½	101	103½
Rochester Gas & Elec., 7% pf.B.	106	105	107
SAFETY CABLE, com. $4.	59½	52½	64½
San Joaquin Lt. & Pwr., 7% pf.	107	105	108
St. Joseph Ry., L., H. & P., 5% pf.	71	70	73
Servel Corp.	7½	5½	10½
Sierra Pacific Elec., com.	24	....	....
Sioux City Gas & Elec., 7% pf.	103½	99	101½
Southeastern Pwr. & Lt., pf.—$7 no par	/104½	....	....
Southeastern Pwr. & Lt., $6 ptc. pf.,	k 76	....	....
Southeastern Pwr. & Lt., com.—no par.	31½	29½	32½
So. Calif. Edison, 8% pf.	35	36½	38
So. Calif. Edison, 7% pf.	28	27½	28½
So. Calif. Edison, 6% pf.	24½	24½	25½
So. Calif. Edison, 8% com.	32½	31½	34½
Southern Cities Utilities, 7% pf.	87	81	86
Southern Cities Utilities, com. $4.	35	....	....
Southwestern Lt. & Pwr., A $3.	63	60	65
Southwestern Lt. & Pwr., B.	63	60	65
Southwestern Lt. & Pwr., $6 pf.	88	83	86
Southwestern Pwr. & Lt., 7% pf.	£106½	103	105½
Springfield (Mo.) Ry. & Lt., 7% pf.	99	95	100½
Standard Gas & Elec., 8% pf.	60½	57½	61½
Standard Gas & Elec., 7% pf.	107	103	106
Standard G. & E., com. $3—no par.	56½	54	58
Standard Pwr. & Lt., 7% pf.	100	98	100
Staten Island Edison, pf.—$6—no par	100	99	101
Superheater, $6 com.—no par.	174	170	185
Syracuse Lighting, 7% pf.	105	103	107
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, 8% com.	300	....	....
TAMPA ELEC., com. $2.	61	....	....
Tenn. Elec. Pwr., 6% pf.	94	92	94½
Tenn. Elec. Pwr., 7% pf.	106	103	106½
Terre Haute, Ind. & East. Trac., 5% pf.	20	20	25
Terre Haute, Ind. & East. Trac., com	1	1	3
Tex. Pwr. & Lt., 7% pf.	/108½	106	108
Tide Water Pwr., 8% pf.	107	105	108
Timken Roller Bear., com.—$4 no par.	88½	78	95½
Toledo Edison, 8% pf.	116	115	118
Toledo Edison, 7% pf.	/105	104	105½
Toledo Edison, 6% pf.	k 96	95	97
Toledo Edison, 6% com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	95½	90	97
UNITED GAS & ELEC., 6% pf.	100	98	99½
United Gas & Elec., com.—no par.	m 57	....	....
United Gas & Elec. (N. J.) 5% pf.	72	70	73
United Gas Impr., 8% com.—50.	c 99½	89½	101½
United Lt. & Pwr., pf.—$4—no par.	51½	49	53½
United Lt. & Pwr., pf.—$6.50—no par.	95	87	95
United L. & P., com. A .48—no par.	14	14	16½
United L. & P., com. B .48—no par.	k 16	14	16½
Utah Pwr. & Lt., 7% pf.	j 107½	104	105
Utica Gas & Elec., 7% pf.	105	105	106½
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	94	93	98
Utilities Pwr. & Lt., com. A $2.	27½	27½	30½
Utilities Pwr. & Lt., com. B $1—no par.	14½	13½	15½
VERMONT HYDRO-ELEC., 7% pf.	96½	95	97½
Virginia Elec. & Pwr., 7% pf.	107	105	107
Virginian Pwr., 7% pf.	108	....	....
Virginian Pwr., com.	70	....	....
WAGNER ELEC., 7% pf.	b 81	68	81
Wagner Elec., com.†—no par.	b 27½	18½	26
Washington Ry. & Elec., 5% com.	j240	....	....
Washington Ry. & Elec., 5% pf.	j 92	....	....
Washington Wtr. Pwr., 8% com.	142	136	140
West Mo. Pwr., 7% pf.	m92	....	....
West Penn Elec., 7% pf.	105½	102	109½
West Penn Elec., Cl. A $7.	103½	97½	104½
West Penn Pwr., 7% pf.	115½	111	115½
West Penn Pwr., 6% pf.	106	100½	106½
West Virginia Lt., Ht. & Pwr., 7% pf.	93	94	96
West Va. Utilities, 7% pf.—50.	49½	48	51½
Western Pwr., 7% pf.	99	98	101½
Western States Gas & Elec., 7% pf.	96½	96	98
Western States Gas & Elec., com.	18	....	....
Westinghouse Elec. & Mfg., 8% com.—50.	73½	67½	76½
Weston Elec. Instrument, Cl. A $2.01—no par.	34	30½	34½
Weston Elec. Instrument, com.—no par.	k 16½	15	18½
Wheeling Elec., 6% pf.	100	95	97
Wis., Pwr., Lt. & Ht., 7% pf.	k 95	95	97
Worthington Pump, 7% pf. A.	51	46	54½
Worthington Pump, 6% B.	45½	40	45½
Worthington Pump, com.	31½	20½	32½
YALE & TOWNE com. $5—25.	k 75	70½	76

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, April 23. /Bid price Wednesday, April 27. mLatest quotations available. †Dividend rate available.

extent to which earnings of subsidiaries under the method of financing outlined become the basis of much higher rates on the common stock equities of companies:

	Rate of Earnings on 1924 Total Investment	1924 Common Stock Equity	1925 Total Investment	1925 Common Stock Equity
American Power & Light	14.53	34.81	15.80	40.50
National Power & Light	13.06	16.50	.....	.....
North American	16.45	28.23	.....	.....
Middle West Utilities	12.20	19.03	12.27	21.46
Standard Gas & Electric	14.77	55.22	14.22	37.58

After the payment of interest on outstanding holding company bonds and dividends on preferred stock, any remaining earnings accrue to the benefit of the common stock, the ownership of which, especially so far as it has voting rights, constitutes the chief interest of the promoters in the business of the holding companies. Through their ownership much higher rates of earnings accrue to the management. As shown in the table, the rates for these companies ranged from 16.5 per cent to 55.2 per cent in 1924 and from 21.4 per cent to 40.5 per cent. Whether such distribution of the earnings was actually made depended entirely upon the dividend policies of the holding companies and their subsidiaries, says the report.

France's Electrical Energy Output Increasing

According to statistics of the French Ministry of Public Works the installed capacity of central electric power stations in France on Jan. 1, 1926, totaled more than 5,000,000 kw., of which 3,229,000 kw. was in the form of steam plants and 1,840,000 in hydraulic plants.

When compared with the installations in other European countries for which statistical figures are available, France is stated to rank second, according to the accompanying table.

INSTALLED CAPACITY IN VARIOUS EUROPEAN COUNTRIES

Country	Kilowatts	Kilowatts per Capita
Germany	5,938,000	0.09
France	5,069,000	0.13
Italy	2,369,000	0.05
Norway	1,365,000	0.45
Switzerland	1,360,000	0.34
Sweden	1,148,000	0.23
Belgium	912,000	0.13
Holland	508,000	0.07

The production and consumption of energy in France in 1923 amounted to 7,738,000,000 kw.-hr., or 197 kw.-hr. per capita; in 1924, 9,000,000,000 kw.-hr., or 230 kw.-hr. per capita, and in 1925, 10,000,000,000 kw.-hr., or 250 kw.-hr. per capita. (The figures for 1924 and 1925 are provisional.) Statistics

for Europe show a per capita consumption of 800 kw.-hr. in Switzerland, 238 kw.-hr. in France, 182 kw.-hr. in Germany, 180 kw.-hr. in Italy and 177 kw.-hr. in Great Britain.

French railroads consume per month a total of only 8,100,000 kw.-hr., but their electrification is progressing steadily. The electrification of rural districts and villages has made great progress in France, for at the end of 1926 18,000 out of 39,000 rural communities, or 45 per cent, were supplied with electric power.

New Foreign Loan Floated

Twenty-five-year 7 per cent external sinking fund gold bonds of the Adriatic Electric Company (Società Adriatica di Elettricita) were offered during the past week at 96 and interest to yield 7.35 per cent, a piece of financing involving a total of $5,000,000. A substantial portion of this offering has been withdrawn for sale in Europe. These bonds were dated April 1, 1927, and mature April 1, 1952. The Societa Adriatica di Elettricita was organized in 1905 under the laws of the Kingdom of Italy. It is both an operating and a holding company. The company and its twenty subsidiaries, collectively called the Adriatica Group, are one of the largest and most important hydro-electric companies in Italy. The territory served by the group comprises an area of 17,000 square miles, including fifteen provinces surrounding the northern end of the Adriatic Sea and having a population of 5,500,000, including the important cities of Trieste and Venice.

Duquesne Light Makes New Records

Gross up 8 Per Cent and Output Largest in Company's History—Interest Earned More than 4.15 Times Last Year

THE recent issue of $55,000,000 first mortgage bonds of the Duquesne Light Company—the largest piece of financing this year—throws light on this company's rapid growth and strong present position. Gross and net earnings have each more than doubled since 1919. So have the output and the number of customers.

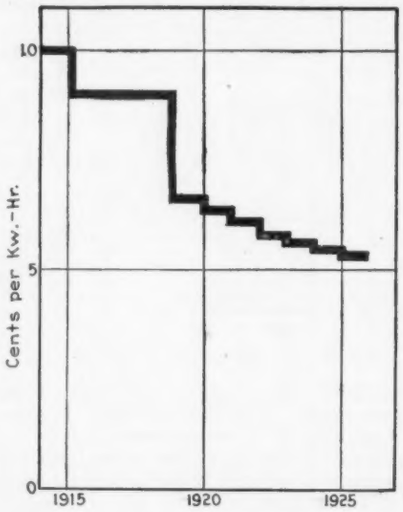
Duquesne Light's record of earnings is among the best. Net available for interest, after deducting all charges including depreciation, for the calendar year 1926, was more than 4.15 times annual interest requirements on the new issue. Such net earnings for the past five years averaged over 3.35 times annual interest requirements. Last year's gross revenue showed a gain of 8 per cent over that of the year before but net declined slightly owing to a rise of 17 per cent in operating costs.

	Dec. 31 1925	1926
	Per Cent	
Debt to capitalization	41	41
Investment to capitalization	80	88
Operating expenses to gross	55	59
Net earnings to gross	45	41
Times bond interest earned	4.10	4.15
Gross revenue to total assets	19	20
Gross revenue to investment	27	27

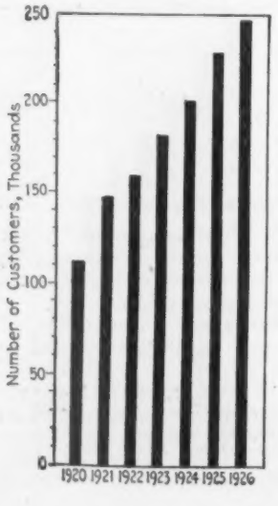
From a standpoint of business 1926 was a record year. The output of 1,332,000,000 kilowatt-hours—the largest in the company's history—was 8.3 per cent over the 1925 record and the number of customers rose 8.2 per cent to 248,307. Domestic consumption of energy increased from an average of 560 kilowatt-hours per customer in 1925 to 599 kilowatt-hours last year, a 7 per cent gain.

The recent bond issue already referred to provides for the retirement of more than $40,000,000 first mortgage and collateral trust bonds. Most of these bonds had an interest rate of 6 per cent and the balance 5½ per cent, while the new bonds bear a 4½ per cent rate. The present authorized indebtedness of the company is $100,000,000 but the new issue will represent the only outstanding debt.

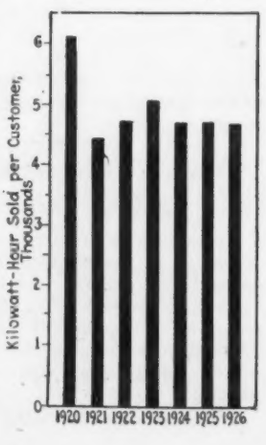
The per cent ratios shown in the accompanying table illustrate the year's progress.



COST OF POWER TO THE CONSUMER HAS SHOWN RAPID DECLINE OVER TEN-YEAR PERIOD



DUQUESNE LIGHT COMPANY REPORTS MARKED GROWTH IN NUMBER OF CUSTOMERS DURING SEVEN-YEAR PERIOD



SALES OF ELECTRICAL ENERGY IN KILOWATT-HOURS PER CUSTOMER BY DUQUESNE LIGHT COMPANY SINCE 1920

New Capital Issues

During the week ended April 28 the Public Service Company of Oklahoma issued first mortgage 5 per cent gold bonds, series D, to the amount of $8,500,000, the price being 97½ and interest, yielding over 5.15 per cent. Proceeds of these bonds will be applied toward acquisition of additional property and for other corporate purposes.

The People's Light & Power Corporation issued 19,000 shares of $6.50 cumulative preferred stock at $93.50 per share and accrued dividend, to yield about 6.96 per cent.

First mortgage 5½ per cent gold bonds of the Maysville Public Service Corporation were recently offered to the amount of $900,000 at 97 and accrued interest to yield 5.80 per cent.

The Southwestern Gas & Electric Company issued first mortgage 5 per cent gold bonds, series B, to the amount of $5,000,000 at 96½ and interest, yielding about 5.23 per cent.

Collateral-trust sinking-fund gold bonds of the Inland Power & Light Corporation were offered at 96 and accrued interest, to yield about 6.30 per cent, a piece of financing involving $3,000,000.

Securities Called in April Total $111,615,500

Bonds and notes of electric light and power companies called for payment in April in advance of maturity will amount to $111,615,500. This substantial total compares with $44,772,800 in March and $29,672,300 in February.

Issues	Due	Amount
Public Service Electric Power, 6s	1948	$13,959,000
Georgia Railway & Power, 5s	1954	11,546,000
Georgia Railway & Power, 6s	1954	2,915,000
Georgia Railway & Power, 6s	1947	3,436,500
Georgia Railway & Power, 7s	1941	4,000,000
Associated Gas & Electric, 6s	1955	10,232,500
Illinois Power & Light, 7s	1953	9,614,800
Indianapolis Light & Heat, 5s	1940	3,782,000
Dubuque Electric, 6s	1942	3,200,000
Commonwealth Pwr. & Lt., 6½s	1933	2,700,000
Lexington Utilities, 6s	1946	2,522,950
Lexington Utilities, 6s	1929	316,800
Lexington Utilities, 6s	1936	179,200
Potomac Public Service, 7s	1944	2,214,500
Montpelier & Barre Lt. & Pwr., 5s	1944	1,741,800
Potomac Electric Power, 7s	1941	1,689,000
Iowa Light, Heat & Power, 5s	1946	1,630,000
Tide Water Power, deb. 7s	1937	1,477,000
Midland Cos. Pub. Serv. 7½s	1956	1,254,000
Midland Co's. Pub. Serv., 6s	1952	385,000
Otter Tail Power, ref. 6s	1933	1,000,000
Jackson Public Service, 6s	1934	955,000
Jackson Public Service, 7s	1934	400,000
New England Company, 5½s	1942	770,000
Commonwealth Pwr. & Lt., 7½s	1942	500,000
Iowa Light, Heat & Power, 7s	1946	450,000
Consumers Utility, 6s	1937	159,400
Franklin Water, Lt. & Pwr., 5s	1929	119,800
Southern Ohio Pub. Service, 6s	1945	1,000,000
Pittsburgh Utilities, 5s	1928	10,000,000
Cities Service, cv. D, 7s	1966	14,980,380
Cities Service, cv. E, 8s	1966	1,759,940
Cities Service, cv. B, 7s	1966	725,730

Manufacturing and Markets

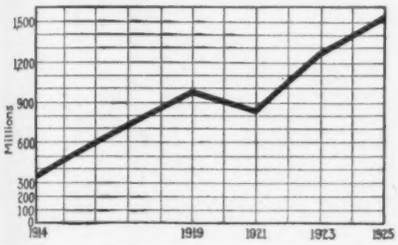
1925 Census of Electrical Manufactures

Biennial Census of Department of Commerce Shows an Increase of 19.1 Per Cent as Compared with 1923—1,739 Establishments Report in 1925, 1,671 in 1923

ACCORDING to data collected in the biennial census of manufactures by the Department of Commerce, the establishments engaged primarily in the manufacture of electrical machinery, apparatus and supplies reported for 1925 a total output valued at $1,540,002,041, an increase of 19.1 per cent, as compared with $1,293,001,771 for 1923, the last preceding census year. The total for 1925 was distributed as follows: Batteries, $155,245,226; control apparatus, $31,032,159; fans, $12,562,636; generators, motor-generator sets, and transformers, $172,005,613; household, heating and cooking appliances, $74,726,908; ignition apparatus for internal-combustion engines, $41,364,998; industrial apparatus and appliances, not including motor-driven tools and devices, $10,279,978; interior conduits and fittings, $43,328,140; incandescent lamps, $73,558,210; measuring instruments, relays and instrument transformers, $31,650,355; motors, $112,543,596; radio apparatus, $170,197,861; switchboards, panelboards, circuit breakers and switches, $69,072,044; telephone and telegraph apparatus (not including wireless), $84,421,231; wiring devices, $34,682,619; miscellaneous electrical machinery, apparatus and supplies, $327,616,225, and all other products, including contract and repair work, $95,714,242.

In addition, electrical machinery, apparatus and supplies are manufactured to some extent as secondary products by establishments engaged primarily in other lines of manufacture. The value of such commodities thus produced outside the industry proper in 1923 was $82,465,360, an amount equal to 6.4 per cent of the total value of products for the industry as classified. The corresponding value for 1925 has not yet been calculated, but will be shown in the final report of the present census.

Of the 1,739 establishments report-



VALUE OF MANUFACTURED ELECTRICAL PRODUCTS OBTAINED FROM BIENNIAL CENSUS OF MANUFACTURERS

Table I—Summary for the Industry, 1925 and 1923

	1925	1923	Per Cent of Increase
Number of establishments	1,739	1,671	4.1
Wage earners (average number)*	239,921	234,892	2.1
Maximum month	Nov. 237,418	Dec. 245,321	....
Minimum month	June 218,717	Jan. 220,154	....
Per cent of maximum	80.0	89.7	....
Wages†	$323,834,541	$305,455,263	6.0
Cost of materials (including fuel, electric power, and containers)†	$636,692,076	$548,626,673	16.1
Products, total value†	$1,540,002,041	$1,293,001,771	19.1
Electrical machinery, apparatus and supplies	$1,444,287,799	$1,222,185,639	18.2
Other products	$95,714,242	$70,816,132	35.2
Value added by manufacture‡	$903,309,965	$744,375,098	21.4
Horsepower	589,398	480,268	22.7

* Not including salaried employees.

† The amount of manufacturers' profits cannot be calculated from the census figures, for the reason that no data are collected in regard to a number of items of expense, such as interest on investment, rent, depreciation, taxes, insurance, and advertising.

‡ Value of products less cost of materials; in other words, the value created by the manufacturing processes. The cost of materials does *not* include wages, salaries or the items of expense specified in footnote *b*.

Table II—Products, by Kind, Quantity and Value, 1925 and 1923

	1925	1923
Total value	$1,540,002,041	$1,293,001,771
Batteries, total value	$155,245,226	$118,065,613
Storage batteries:		
Weight of plates, lb.	388,264,038	226,106,900
Value	$88,870,186	$66,922,291
Primary batteries:		
Dry cells—		
Number	530,997,016	221,859,834
Value	$37,238,607	$18,903,269
Wet batteries—		
Number	2,776,886	1,883,572
Value	$3,743,252	$2,542,829
Battery parts and supplies, value	$25,393,181	$29,697,224
Control apparatus, total value	$31,032,159	$33,176,615
Industrial magnetic control for alternating-current motors:		
Number	129,715	70,552
Value	$5,554,693	$4,233,099
Industrial magnetic control for direct-current motors, value	$6,324,568	$4,002,829
Industrial manual control for alternating-current motors:		
Number	417,768	*
Value	$6,089,381	$7,934,089
Industrial manual control for direct-current motors, value	$1,608,912	$4,335,781
Other control apparatus, including railway and vehicle controllers, field rheostats, generator-voltage regulators, theater dimmers, battery-charging rheostats, miscellaneous rheostats and resistance units (not including radio rheostats), etc., value	$11,454,605	$12,670,817
Fans, electric, total value	$12,562,636	$12,053,861
Desk fans:		
Number	769,163	610,261
Value	$8,818,952	$7,933,397
Ceiling and column fans:		
Number	63,976	51,538
Value	$1,835,256	$1,649,215
Exhaust fans (power-motor type):		
Number	19,864	
Value	$1,666,867	*
Ventilating fans (desk-fan type):		$2,471,249
Number	12,695	
Value	$241,561	
Generators, motor-generator sets, and transformers, total value	$172,005,613	$165,491,396
Generators, other than automotive generators or self-contained power and lighting outfits:		
Alternating current—		
Steam-turbine-driven—		
Number	386	594
Kilovolt-amperes	2,054,125	2,266,968
Value	$8,468,376	$9,317,122
Other, including synchronous condensers and frequency changers—		
Number	1,712	1,381
Kilovolt-amperes	1,619,895	*
Value	$9,431,072	$9,191,158
Direct current—		
Steam-turbine driven—		
Number	6,562	2,247
Kilowatts	45,445	20,252
Value	$1,514,708	$762,761
Other†		
Number	9,778	8,061
Value	$3,801,820	$3,472,524
Motor-generator sets and dynamotors:		
Number	14,119	8,195
Value	$8,264,118	$7,304,964
Automotive generators and starter motor:		
Number	3,879,208	3,730,945
Value	$56,221,356	$54,007,391

(*Table II continued on page 990*)

Table II—Products, by Kind, Quantity and Value, 1925 and 1923 (Concluded)

	1925	1923
Self-contained power and lighting outfits not over 5-kw. capacity, including engine, generator and control, but excluding storage batteries:		
Number	42,769	41,816
Value	$10,916,807	$7,684,977
Parts and supplies for generating apparatus, value	$11,234,201	$14,635,777
Transformers, induction voltage regulators, and current-limiting reactors:		
Constant-potential transformers—		
Less than 1 kva.†—		
Number	1,191,588	
Value	$2,937,398	641,792
1 to 500 kva.—		4,790,163
Number	195,671	$31,187,794
Kilovolt-amperes	3,981,777	
Value	$28,766,327	
Over 500 kva.—		
Number	3,374	3,406
Kilovolt-amperes	8,214,441	7,713,719
Value	$20,233,698	$18,506,209
Constant-current transformers (except measuring instrument and radio transformers), current-limiting reactors, induction voltage regulators, synchronous converters, and double-current generators, value	$10,215,532	$9,420,719
Household, heating and cooking appliances, total value	$74,726,908	$67,002,084
Air heaters, convector and radiant type:		
Number	416,654	310,363
Value	$1,701,368	$1,862,180
Cooking utensils:		
Percolators—		
Number	434,095	260,030
Value	$3,593,496	$2,340,446
Toasters (two-slice)—		
Number	735,856	476,606
Value	$1,885,780	$1,433,409
Waffle irons—		
Number	306,527	131,445
Value	$1,806,949	$788,669
Curling irons:		
Number	1,534,786	*
Value	$1,703,088	$1,480,395
Disc stoves, hot plates and ranges under 2½ kw.:		
Number	178,585	
Value	$933,929	*
Domestic ranges, 2½ kw. and over:		$3,676,645
Number	70,931	
Value	$5,587,296	
Flatirons:		
Number	2,759,218	2,434,280
Value	$7,557,262	$8,198,941
Vacuum cleaners:		
Number	1,097,640	1,240,742
Value	$39,591,336	$35,981,514
Water heaters (over 660 watts):		
Number	53,936	14,507
Value	$708,016	$406,199
Miscellaneous household, heating and cooking devices, not included above, value	$9,658,388	$10,833,686
Ignition apparatus for internal-combustion engines, total value	$41,364,998	‡
Spark plugs:		
Number	61,751,039	*
Value	$13,675,535	$13,659,921
Coils, value	$7,836,656	$7,867,710
Magnetos, value	$9,681,227	$10,303,620
Timers, value	$10,171,580	‡
Industrial apparatus and appliances, not including motor-driven tools and devices, total value	$10,279,978	$6,788,157
Arc welding apparatus, including generating units or transformers	$1,755,962	$778,756
Commercial cooking apparatus (hotel ranges, broilers, bread-baking ovens, toasters, urns, etc.)	$1,568,740	$749,463
Complete industrial electric heating devices (soldering irons, melting pots, kettles, etc.)	$1,343,918	$725,154
Electric furnaces	$1,047,576	$731,790
Industrial electric heating units (space heaters, immersion heaters, and other miscellaneous industrial heating units)	$1,732,457	$1,151,551
Industrial electric ovens and electric heating equipment for such ovens	$1,174,217	$995,931
Spot and resistance welding apparatus	$1,657,108	$1,655,512
Interior conduits and fittings, total value	$43,328,140	$35,305,341
Armored conductor and fittings	$10,906,375	*
Flexible-steel conduit	$1,197,478	*
Rigid-steel conduit, and elbows and couplings	$16,874,284	*
Nonmetallic conduit	$3,554,986	*
Metal raceways for surface wiring, outlet boxes, switch boxes, lock nuts, bushings and fittings	$10,795,017	*
Lamps (bulbs only), incandescent, total value	$73,558,210	$71,966,225
Tungsten:		
Other than miniature types—		
Number	266,461,754	232,699,601
Value	$54,892,438	$54,179,645
Miniature types—		
Automobile—		
Number	114,800,550	88,243,456
Value	$12,432,676	$11,354,546
Other miniature types—		
Number	65,946,289	61,008,765
Value	$4,840,733	$4,860,701
Carbon, including miniature types:		
Number	7,102,572	7,420,528
Value	$1,392,363	$1,571,333
Measuring instruments, relays, and instrument transformers, total value	$31,650,355	$28,221,484
Watt-hour meters:		
Number	2,285,089	2,011,486
Value	$18,186,206	$16,987,548
Demand meters and ampere-hour meters, value	$1,043,936	$898,591
Indicating instruments:		
Graphic recording meters, value	$507,603	$697,925
Laboratory testing and scientific instruments, value	$1,507,995	$1,769,228
Miniature, 3½ in. and under, value	$2,787,181	$1,555,137
Portable meters, other than miniature—		
Number	56,231	28,958
Value	$1,460,019	$810,840
Switchboard instruments, value	$2,412,567	$1,964,762
Instrument and meter transformers:		
Number	114,402	126,442
Value	$1,773,161	$2,275,943
Relays, other than industrial motor control:		
Number	229,224	83,567
Value	$1,971,687	$1,261,510
Motors, total value	$112,543,596	$109,188,685
Stationary, not including fan motors:		
Fractional horsepower—		
Number	2,288,348	1,994,931
Value	$28,249,265	$23,939,172
One horsepower and over—		
Direct current—		
Number	77,637	59,256
Horsepower	635,130	533,394
Value	$15,796,626	$13,865,447
Alternating current—		
Polyphase induction—		
200 hp. and under—		
Number	248,396	296,519
Value	$34,653,950	$35,586,235
Over 200 hp.—		
Number	1,246	1,045
Value	$2,713,797	$1,917,553
Single phase—		
Number	75,688	53,227
Value	$5,670,586	$4,417,802
Synchronous motors—		
Number	1,985	2,588
Horsepower	931,514	*
Value	$5,309,331	$5,051,501
Railway and vehicle motors, not including automotive starter motors, value ‖	$7,514,547	$10,586,043
Motor parts and supplies, value	$12,635,494	$13,824,932
Radio apparatus§, total value	$170,197,861	$54,000,470
Radio tubes:		
Number	24,015,443	4,687,400
Value	$21,170,610	$9,824,172
Other radio apparatus, value	$149,027,251	$44,176,298
Switchboards, panelboards, circuit breakers, and switches, total value	$69,072,044	$57,856,166
Switchboards for light and power, not including panelboards nor industrial-control panels	$18,461,273	$18,775,862
Panelboards for light and power	$5,866,628	$3,903,898
Cabinets, junction boxes, and pull boxes	$1,628,987	$1,964,330
Oil circuit breakers, for sale as such	$17,891,246	$12,256,844
Air circuit breakers, for sale as such	$2,596,599	$2,952,356
Knife switches, not including industrial motor-control switches	$7,782,589	$5,753,943
Other switches and switchboard accessories	$14,844,722	$12,248,933
Telephone and telegraph apparatus (not including wireless), total value	$84,421,231	$94,483,885
Telephone apparatus and appliances:		
Switchboards, central office and private branch exchange	$42,463,527	$50,552,822
Substation instruments	$18,401,666	$22,748,623
Interior systems	$4,433,383	$19,096,586
Parts for telephone apparatus and appliances	$16,200,492	
Telegraph apparatus (not including wireless)	$2,922,163	$2,085,854
Wiring devices, total value	$34,682,619	$34,966,232
Lamp sockets and receptacles	$14,825,623	$14,815,915
Snap switches, flush, surface and pendant	$7,014,699	$6,361,393
Attachment plugs and plug receptacles	$4,294,683	$4,378,900
Other wiring devices	$8,547,614	$9,410,024
Miscellaneous electrical machinery, apparatus, and supplies, total value	$327,616,225	$301,788,174
Electro-therapeutic apparatus (exclusive of X-ray tubes and motor-driven devices)	$9,763,358	$5,991,382
Electrodes for electric lighting and electric furnaces, brushes, and carbon specialties	$13,955,483	$14,745,541
Fire-alarm apparatus	$3,489,828	$2,639,919
Flashlight cases	$4,720,487	$3,642,418
Fuses and fuse blocks	$10,302,215	$9,245,283
Insulators	¶$17,857,503	¶$16,374,082
Lightning arresters and choke coils	$5,961,111	$3,833,631
Overhead trolley-line material, including brackets for electric and industrial railways, mines, etc. (Items known as pole-line hardware and trolley and span wire are not included)	$4,239,547	$8,796,369
Railway signals and attachments	$14,029,779	*
Rectifying apparatus, vibrating, mercury and other	$8,917,192	$4,251,495
Searchlights; floodlights; motion-picture, photo-engraving, and stage projectors; headlights, not including motor-vehicle headlights	$2,687,038	$2,478,988
All other electric machinery, apparatus and supplies	$231,692,684	$229,789,066
All other products	$88,827,615	$59,873,805
Contract work and repairing	$6,886,627	$10,942,327

* No comparable data.
† Data for capacity incomplete.
‡ Data for timers not called for separately on 1923 schedule; included with "All other electrical machinery, apparatus, and supplies."
‖ See "Automotive generators and starter motors," under "Generators, motor-generator sets, and transformers."
§ Detailed statistics on production of radio apparatus published Oct. 16, 1926.
¶ In addition, porcelain insulators to the value of $21,826,971 in 1925 and $21,248,382 in 1923, were made by establishments engaged primarily in the manufacture of pottery.

ing for 1925, 334 were in New York, 236 in Illinois, 205 in Ohio, 142 in New Jersey, 133 in Pennsylvania, 116 in Massachusetts, 110 in California, 65 in Connecticut, 57 in Indiana, 55 in Wisconsin, 54 in Missouri, 53 in Michigan, 28 in Minnesota, 24 in Washington, 15 in Rhode Island, 14 in Maryland, 10 in Kentucky, 10 in Oregon, 9 in Iowa, 8 each in Kansas, New Hampshire, and Texas, 7 in West Virginia, 6 in Colorado, 5 in Virginia, 4 in Oklahoma, 3 each in Alabama, Georgia, North Carolina, Tennessee and Utah, 2 in Arkansas, 2 in Florida, and 1 each in District of Columbia, Louisiana, Maine and South Dakota.

The statistics for 1925 and 1923 are summarized in the accompanying Tables I and II. The figures for 1925 are preliminary and subject to such correction as may be found necessary upon further examination of the returns.

Chamber of Commerce Meeting

Manufacturing Problems Will Be Discussed—Also Public Versus Private Operation of Hydro Plants

QUESTIONS concerning foreign trade, natural resources, insurance, transportation and communications, agriculture, merchandising, manufacturing and finance and civic development will be discussed at special sessions to be held in connection with the fifteenth annual meeting of the Chamber of Commerce of the United States at Washington, D. C., May 2-5. The programs for these sessions have been arranged so as to permit the widest possible discussion of questions of current interest to the various divisions.

Profits in industry are affected by the relations existing between management and men, and for that reason the manufacturers' session will deal with the subjects of industrial relations and wages in relation to costs. In its discussion of industrial relations the meeting will review the developments in this field since the war, with a forward look into the future. The subject of wages will be approached with regard to the rule that wages based on production constitute an almost universal standard today.

Distribution of merchandise on a basis of accurate business data will constitute the subject before the distribution session. Speakers will explain what it is hoped to accomplish in the distribution census recently put under way for the purpose of developing accurate merchandise statistics in all lines of goods. Progress in perfecting methods of utilizing business information will form an allied topic. Trade relations between the United States and Latin America is the principal topic on the program of the foreign commerce meeting. This group will meet jointly with delegates attending the third Pan-American commercial conference. New trends in transportation is one of the two major topics on the program of the transportation and communications meeting. The other is "The Fallacy of Government Ownership of Merchant Shipping."

The importance of the conservation and development of natural resources will be emphasized by Milton E. Marcuse of Richmond, Va., who has represented the natural resources industries on the directorate of the national chamber for four years; W. H. Onken, Jr., editor of the ELECTRICAL WORLD, will speak on "The Hydro-Electric Power Era," Walter Parker of New Orleans will discuss flood control, and Representative Charles Aubrey Eaton of New Jersey will deliver an address on the undesirability of government entering the hydro-electric power field and economic necessity for private operation.

Business Conditions

SALES continue at a fairly steady rate in the industry, although as a whole they are slightly below those of the same period last year. Large equipment orders which are expected to be placed during this quarter will probably make sales during that period reach a high total. Despite bad weather conditions and unusually high water in the St. Louis district sales are fair. Flood conditions in the Mississippi Valley have retarded activities in Mississippi and Louisiana, which two states were previously active in the market. Textile mill electrification business is prominent and industrial buying is fair with many interesting prospects in view.

In New England there is little change from the even trend in sales, and central-station supplies are moving steadily with a fair demand for small switching equipment. Industrial electric lighting is very active with negotiations in greater volume than at this period last year. Utility companies are more active in the New York district and there has been a good demand for transformers and switching equipment. Industrial plant buying is steady. Many power company orders were placed in the Southeast and include two purchases for $100,000 worth of power transformers and switching equipment for Alabama and $41,000 worth of switching equipment and aluminum cable for Georgia. An order for $30,000 worth of motors for a textile mill in the Carolinas was also placed. Steady sales in the St. Louis district presage that April business will be above that of the same month last year. Business is spotty in the Middle West but utility companies are active and jobbers report a fair amount of sales. On the Pacific Coast many power company orders were placed, with particular activity noted in the demand for poles and pole-line construction material. Few orders were placed by lumber mills and industrial plants but a number of large jobs are pending and will be closed shortly.

Non-Ferrous Metal Markets Dull —Prices Decline

Copper, lead, zinc, tin, silver, and platinum are all selling at lower prices than last week in the non-ferrous metal market, both here and in London, but the lower prices are not attracting buyers. Copper was held at 13¾ cents last week Thursday, but as early as Friday at least one seller was willing to book orders at 13 cents and did a fair business during the next few days at that level as most others were quoting 13¼ cents. Producers' ranks have gradually weakened to the 13-cent level, however, and that price was general on Wednesday.

A moderate volume of lead business was transacted in the St. Louis market though at definitely lower price levels, 6.55 cents being the prevailing figure since Monday. The New York market has been exceedingly dull and except for contract sales very little lead has brought the Smelting company's official New York price of 7 cents. The speculative situation in London caused a decline in domestic tin to a low of 66½ cents for prompt Straits on Monday. Since then both the foreign and domestic markets have recovered some of the lost ground. Zinc sold at varying prices between 6.25 and 6.35 cents, St. Louis, last week Thursday, with the largest volume at the lower limit.

NEW YORK METAL MARKET PRICES

	April 20, 1927 Cents per Pound	April 27, 1927 Cents per Pound
Copper electrolytic	13¾	13
Lead, Am. S. & R. price	7	7
Antimony	15½–15¾	14¾
Nickel, ingot	35	35
Zinc spots	6.65	6.45
Tin, Straits	68	67½
Aluminum, 99 per cent.	26	26

Base copper price April 27, 1927, 15 cents.

Power Companies Place Many Orders in Southeast

While the bulk of central-station purchases in the Southeast are reflected in small orders, several large individual orders were placed. The largest was from Alabama and called for $60,000 worth of switchboard and switching equipment. Other interesting central-station orders included another from Alabama for $40,000 worth of power transformers and two from the Georgia territory for $25,000 worth of switching equipment and aluminum cable amounting to $16,000. One power company placed two orders for aluminum cable totaling $10,800 and one order for copper wire amounting to $6,200, besides some smaller orders for tree and guy wire. A very satisfactory volume of orders for small power and distribution transformers is reported, orders for distribution transformers from one central-station company amounting to $8,800. Besides wire and cable, other line construction materials are also reported in reasonably good demand, one company having ordered in the past week $15,800 worth of creosoted pine poles and insulators amounting to $8,500.

Activities in the industrial field were reflected in the placing of an order for $30,000 worth of motors for installation

in a textile plant in the Carolinas and an order for wiring materials aggregating $8,000 for a Georgia mill, besides a sizable volume of small orders for motors up to 100 hp. An order for $20,000 worth of motors for a Georgia textile mill is in immediate prospect and the order will undoubtedly be placed within a week.

Utility Companies More Active in New York District

A good demand for diversified apparatus is reported among public utility companies in the New York district. Transformer sales are heavy and include orders for seven 1,000-kva., two 600-kva. and twenty 150-kva. units, together with a good volume of inquiries for this apparatus. Switching equipment is also active, and one manufacturer reports sales during April as almost double in volume those of February. Several good-sized orders for this equipment are expected to be placed during the next few days. There is a fair demand for poles, crossarms, and hardware. Circuit breakers are in fairly active demand and inquiries point to an increase in sales of this apparatus during the next two weeks. Industrial plant buying is steady, with some increase in the demand for control apparatus and transformers, while small and medium-sized motors continue to find a ready market.

Steady Sales in St. Louis District Presage Good April Record

Despite bad weather conditions and unusual high water in a large part of the St. Louis district, business reports show fair sales and the feeling is optimistic among manufacturers and jobbers. Small business is coming in steadily, especially from industrial companies. One of the local power companies has placed an order for switchboard equipment, including circuit breakers and feeder regulators, amounting to $32,000, and a street-car company is buying electric equipment for 50 cars, to cost around $200,000. A small generating unit has been sold for installation in the western part of Missouri. A small city in northern Arkansas has purchased material for a "white-way" and outdoor switching equipment for a substation, totaling over $10,000. An order for transformers for a substation in southeast Missouri, amounting to $2,000, has been booked. Reports indicate that the month's business will be ahead of the same period last year even though the conditions have been somewhat unfavorable.

Business Spotty in Middle West—Utility Companies Active

Considerable variation is noticeable in the volume of business transacted in the Middle West. Industrial activity continues spotty, although there seems to be a little more activity in certain lines. Optimism is prevalent in most industries but conservatism is noted in all lines. Utility companies are actively engaged in construction work and the demand for materials has been quite large as indicated by the commitments of one large company, which are over $85,000 per day. Cable manufacturers report a good demand for their products and deliveries now range from four to six weeks. The demand for pole line hardware apparently has not diminished to any great extent, as the manufacturers are still working night shifts. Jobbers report a fair amount of business transacted. Buying for immediate requirements is being rigidly adhered to. Appliances are moving in good volume with a particularly good demand noted for vacuum cleaners. Electrical refrigeration sales have also accelerated and a good volume of business is expected in this line.

Even Trend Marks Sales in New England District

Little change from the even trend in sales is noted in the New England district. Central-station supplies are moving steadily with a fair demand for small switches, for which a number of such orders for substation needs were recorded, amounting to about $10,000. Shipments of good-sized quantities of wire and pole-line materials are reported. Small motor sales are steadier. Power equipment is quite active and includes a textile mill development in southern New England which will install about 2,300 hp. and a number of loom motors ranging from 15 hp. up. Inquiries for transformers are also increasing.

Industrial electric lighting is very active with negotiations greater in volume than at this period last year. Sales of kitchen-lighting units have been very encouraging, and street-lighting prospects are promising and consist of numerous extension plans. Contractors are interested in new construction supplies and wiring contracts are being signed in good volume. The demand for fiber conduit is heavy. House service extensions are planned for the Cape district of southeastern Massachusetts and will include a 12-mile line with branches. Jobbing reports show varying trends with a general unevenness.

Many Power Company Orders Placed on Pacific Coast

Many orders for power company construction material have been placed on the Pacific Coast. One company in north-central California is in the market for 1,000 assorted sizes of treated poles and 2,500 untreated poles. Another company is asking for quotations on 4,000 poles for use in the San Joaquin valley. Other power company orders include $1,500 worth of 3½-in. fiber conduit, two carloads of 4-way tile ducts, and a fair amount of pole-line construction material. A Fresno dealer has placed an initial order for 200 fans, mostly of the ceiling and larger desk sizes, having a value of about $3,500. Other special orders include beacon, flood and border lights and accessories valued at $7,000 for the San Francisco new air port at Millbrae. A cement plant at Riverside purchased a bank of three transformers, together with several smaller units valued at about $30,000. A carload of 2,500 house-type watt-hour meters valued at $25,000 has been purchased by a power company in the Bay district. An order of interest covered 3,000 pin-type insulators, for 22,000-volt service, valued at $7,500.

In the Puget Sound district there were few orders placed by lumber mills and industrial plants, although several large jobs are pending. These include a 100-ton sulphite plant in Aberdeen, a pulp and paper mill in Bellingham, a cold storage plant in the Yakima district and the enlargement of a power plant of the Long Bell Lumber Company at Longview, involving two additional boilers and a fourth 6,000-kw. generator. A Seattle jobber reports the sale of a number of small motors from 1 to 10 hp. for pumping plants in the Wenatchee and Yakima fruit orchards, for a laundry plant in Seattle and for a cold storage plant in the Puyallup Valley. The city of Seattle will shortly call for bids for changing its street-lighting system in the retail district. The work will involve an expenditure of approximately $100,000.

Activities of the Trade

Lighting Equipment Association Adopts Fair Trade Practices

A meeting of the stamping and parts manufacturers' group of the Artistic Lighting Equipment Association was held at association headquarters in the Graybar Building, New York City, on Thursday, April 21, 1927. J. W. Schulze, president of Alfred Vester Sons, Inc., Providence, R. I., was elected to head this group. A credit bureau was set up for the exclusive use of members of this group, and a program adopted for the elimination of destructive trade practices and the increased use of brass parts for the lighting equipment trade. It was the sense of the meeting that all manufacturers of stampings and parts should charge for tools and dies on the first bill rendered. A significant decision in the meeting related to the copying of designs and patents. To put a stop to this practice it was unanimously voted that all firms whose representative was present would avoid producing designs in stampings and parts which were close imitations of others, whether patented or not.

Century Electric Stock Dividend Did Not Decrease Surplus

In the annual report of the Century Electric Company, St. Louis, for the fiscal year ended Dec. 31, 1926, gross earnings are recorded as $1,321,138, which compares with $1,375,147 in 1925. During 1926 the company paid a 10 per cent stock dividend and at the same time did not reduce its surplus below that carried forward from 1925. Its surplus on Dec. 31, 1926,

was $800,154. The company is now spending $200,000 on its Twenty-first Street warehouse and yard adjoining to increase its shipping facilities.

During the year the company purchased about eight acres of ground between Forest Park Boulevard and Market Street. A portion of this will be used for an iron foundry to be constructed in the near future. The company has arranged for a real estate loan of $750,000 at 5½ per cent with maturities up to five years. Most of the notes have been purchased by the Federal Commerce Trust Company but the company has held 150 thousand-dollar bonds from the issue for sale to individuals in its organization as additional finances are needed. During the six years ended Dec. 31, 1926, the company's net sales totaled over $26,500,000 with credit losses of less than one-fourth of one per cent.

Servel Elects New President and Sells Wheeler Holdings

The holdings of common stock of the Wheeler Condenser & Engineering Company have been sold for cash by the Servel Corporation, but as additional consideration the latter has retained for two years the plant of the Wheeler company at Newburgh, N. Y. At the annual organization meeting of the board of directors this week an executive committee consisting of H. G. Scott, Richard E. Forrest and Frank E. Smith was formed. Frank E. Smith was elected president and also a director in place of Thomas H. Blodgett, who has resigned. The other directors were re-elected.

General Electric Company Holds Industrial Heating Course

The sixth industrial heating course was begun by the General Electric Company at Schenectady on April 18 and continued to April 30. A total of 40 representatives of various central-station companies throughout the United States attended the course. These courses are given under the auspices of the N. E. L. A., and their object is to acquaint the central-station companies with the possibilities of the industrial electric heating load, the field of application and the equipment available. Meetings were held both at the Schenectady and Pittsfield plants of the General Electric Company, and an intensive course of lectures was carried on daily. Inspection trips were taken to installations at Springfield, Worcester, Lynn, Beverly and Salem, Mass.; Rochester, N. Y., and Erie, Pa.

R. H. Beaumont Takes Over American Manufacturing

The business of the American Manufacturing & Engineering Company of Kalamazoo, Mich., has been taken over by the R. H. Beaumont Company, 319 Arch Street, Philadelphia, and the products formerly made by that company, including the American slack lime cableway excavator, will now be manufactured by the Beaumont company. S. O. Nafziger, president of the American company will be associated with the Beaumont company. The company states that the addition of the American slack lime cableway excavator to its line, which already includes the Beaumont LeClair cable drag scraper, completes a full line of equipment for elevating and storing coal, sand, gravel, stone and kindred materials. The Beaumont company will sell the complete system for this service, including the hoist.

The Electric Household Utilities Corporation, Chicago, reports for the year ended Dec. 31, 1926, a net income of $131,365 after the deduction of all charges. This is equal to 35 cents per share on 374,138 capital shares outstanding, and compares with $729,330 or $4.04 per share on the 180,573 capital shares outstanding in 1925. During the year the company wrote off $1,000,000 of good will, bringing that item down to $618,977.

The Frigidaire Corporation, Dayton, Ohio, announces a new model Frigidaire, selling at the lowest price in the history of the company. Its cooling mechanism is built in a single unit, concealed in the top of a specially designed metal cabinet.

The Page & Hill Company, 814 Plymouth Building, Minneapolis, has published the second edition of its "Handbook of Practical Information About Cedar Poles and Butt-Treating." This second issue incorporates not only the information contained in the first edition but much additional material requested by pole users since the first publication. The handbook contains complete specifications for northern white and western red cedar poles, illustrations of the proper and improper methods of measuring, painting and storage of poles and many other items. One section of especial interest covers the proper and improper method of unloading and handling poles.

The National Pole & Treating Company, Minneapolis, announces that its New York headquarters, formerly at 220 Broadway, is now located at Rooms 836 and 837, 101 Park Avenue.

The American Brown Boveri Electrical Corporation, 165 Broadway, New York, it is rumored, has concluded negotiations with the Maschinenfabrik Augsburg Nurnberg A. C., Germany, for a license to manufacture the M. A. N. Diesel engines for railroad traction service in the United States, including electric main line locomotives, switching locomotives and Diesel rail cars. It is said that the company plans to develop a portion of its plant at Camden for this branch of production.

The Westinghouse Electric & Manufacturing Company has appointed J. P. Alexander district manager of its New England office located at 10 High Street, Boston. Mr. Alexander succeeds George H. Cox, who becomes sales manager at the South Philadelphia works of the company. H. Van Blarcom, formerly prime mover sales manager at the South Philadelphia works, will go to Pittsburgh as soon as he can be released and will there represent the sales division in educational department work.

New Equipment Available

Magnetic Brake

The type WB magnetic brake which permits quick removal of the motor armature with the brake wheel in place without the necessity of taking the brake apart or disturbing any of its adjustments has been developed by the Electric Controller & Manufacturing Company, Cleveland. The type WB brake has no levers or rods passing over the top of the brake wheel. The brake shoe arms are caused to operate in opposite directions by means of a simple lever movement having the connecting link within the base below the wheel.

Asbestos Insulated Motor

An automatic self-start ball-bearing motor using "asbestosite," a new heat-resisting compound the base of which is asbestos and which has been developed especially for protecting the windings of electric motors and to improve the heat-resistant qualities of motor insulation, has been placed on the market by the U. S. Electrical Manufacturing Company, 200 East Slauson Avenue, Los Angeles. The manufacturer claims that "asbestosite" is non-combustible, non-burning, practically fireproof and will not absorb moisture.

The stator slots of the motors are first lined with treated asbestos and the windings are inserted. Between phases, where the difference of potential is highest a formed barrier of treated asbestos is built into the windings, then "asbestosite" is forced into and around the windings under high pressure, and a final coat completely encases the exterior windings.

Trolley Mast Arm

The Peirce "Presteel" trolley mast arm has been developed by Hubbard & Company, Pittsburgh, in both the rigid type and the chain type. The rigid type is for where lamps need not be hung more than 5 ft. from the pole. It is braced against stresses, and the base of the arm is made of pressed steel which allows bending to any angle. The spreader bracket is adjustable and can be placed at any point on the arm.

With the chain type of arm the lamp can be adjusted and locked in any position on the arm to clear foliage. For inspecting the lamp the lamp trimmer climbs the pole, unlocks the handle and by revolving it pulls the lamp to him. The carriage is operated by a continuous chain completely protected. All movable parts are made of non-rusting alloy metal and all other parts are hot double-dip galvanized.

New Trade Publications

PORTABLE ELECTRIC TOOLS. — The Black & Decker Manufacturing Company, Towson, Md., has issued catalog No. 14, covering the Black & Decker portable electric tools and shop equipment, including portable electric drills, grinders, socket wrenches, valve grinders, valve refacers, attachments and accessories. Illustrations showing the progress of the company from 1910 to 1927 are included.

GENERATOR AIR COOLER.—Bulletin No. 1217 issued by the Griscom-Russell Company, 285 Madison Avenue, New York City, entitled "The U-Fin Generator Air Cooler," describes the special features of this apparatus and explains the applications of the "U-Fin" coolers. Illustrations showing typical installations in central stations and industrial plants are included.

DISTRIBUTION TRANSFORMERS. — The Wagner Electric Corporation, 6400 Plymouth Avenue, St. Louis, has issued bulletin No. 148, describing and illustrating the Wagner single-phase distribution transformers, "HE" type, available in ratings from 1½ kva. to 200 kva., 2,300 to 115/230 volts, 60 cycles, single-phase. This bulletin contains a detailed description of the material used and the production of the transformers. Tables giving capacities and dimensional diagrams are included.

ORNAMENTAL LIGHTING UNITS.—Bulletin GEA-715 issued by the General Electric Company, Schenectady, N. Y., describes and illustrates the "Novalux" ornamental lighting units, form 12, for street lighting. Dimension tables for form 12 "Novalux" ornamental units for poles and brackets with 5-in. tops are included.

DIRECT-CURRENT MOTORS.—Bulletin No. 200 issued by the Reliance Electric & Engineering Company, Ivanhoe Road, Cleveland, describes its type T heavy-duty "Reliance" motors for direct current. Many illustrations show the construction of the different parts entering into the motor and a table of rating and general outline dimensions give the characteristics of the different sizes and speeds. A number of photographs of installations of the motors are included. In the bulletin the company calls attention to the fact that many improvements have been made to its type T line, but for the last eleven years no change has been made which affects interchangeability.

STREET LIGHTING.—"Street Lighting and the Central Station" is the title of special publication No. 1762 issued by the Westinghouse Electric & Manufacturing Company. This is an excellent bulletin calling attention to the value of the street-lighting load and explaining why electric service companies should sponsor more and better street lighting. What constitutes good lighting is explained and a chapter is devoted to "Rates—What They Should Include." The booklet also discusses the future of street lighting, traffic warning beacons, getting new street-lighting business and getting new business from old installations.

ELECTRIC HEATING DEVICES.—The Acme Electric Heating Company, 1207 Washington Street, Boston, is distributing catalog C, entitled "Acme Electric Heating Heat Control and Resistor Units," including circulation-water heaters, immersion heaters, electric steam boilers, steam tables, wax pots, glue pots, melting ladles, etc. Attention is also called to its electrical household appliances.

Foreign Trade Opportunities

Following the listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency are desired in Prague, Czechoslovakia (No. 25,025), for electric hair wavers.

Purchase and agency are desired in Fulda, Germany (No. 25,097), for electrical household appliances.

An agency is desired in Antwerp, Belgium (No. 25,145), for dry and storage batteries, electrical household appliances and radio sets and parts.

An agency is desired in Bogota, Colombia (No. 25,150), for electrical appliances.

An agency is desired in Hamburg, Germany (No. 25,141), for electrical floor polishers.

An agency is desired in Lisbon, Portugal (No. 25,143), for electrical household appliances.

An agency is desired in Berlin, Germany (No. 25,144), for electrical household appliances; for electric motors and hand and portable electric tools (No. 25,147); also for electric tools, hammers and chippers (No. 25,148).

An agency is desired in Punta Arenas, Chile (No. 25,239), for electrical household appliances, especially vacuum cleaners and labor-saving devices, lamps, carbide and mine safety appliances.

An agency is desired in Vienna, Austria (No. 25,142), for electric refrigerators.

An agency is desired in London, England (No. 25,146), for electric refrigerators.

Purchase is desired in Hamilton, Canada (No. 25,139), of thermostats for use with forced draft system.

An agency is desired in Cologne, Germany (No. 25,140), for electric washing machines.

An agency is desired in Beirut, Syria (No. 25,149), for wiring supplies.

Purchase and agency are desired in San Sebastian, Spain (No. 25,216), for water turbines for electric development of 5,000 hp.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

FALL RIVER, MASS.—The Howard-Arthur Mills, Inc., East Warren Street, plans to build a substation for electric service, at its works. Plans have also been approved for the complete electrification of the mill.

SPRINGFIELD, MASS.—The Board of Works is considering the installation of an improved street lighting system maintained by underground wires on State Street in the vicinity of Benton Street.

SPRINGFIELD, MASS. — The Hoosac Valley Lime Company, Howland Avenue, plans to install electric power equipment in connection with proposed extensions and improvements in its plant, to cost about $175,000.

NEW HAVEN, CONN.—Plans have been filed by the United Illuminating Company for the construction of a substation on Putnam Avenue, to cost about $20,000.

Middle Atlantic States

ALBANY, N. Y.—The Central Railway Terminal & Cold Storage Company, care of Moores & Dunford, 110 East Forty-second Street, New York, architects and engineers, has plans for a cold storage and refrigerating plant at Montgomery and Colonie Streets, to cost about $1,000,000.

BROOKLYN, N. Y.—Plans are being prepared by the Brooklyn Edison Company for a general service, equipment and repair building at Fourth Avenue and Third Street, to cost about $750,000. Voorhees, Gmelin & Walker, 342 Madison Avenue, New York, are architects.

CORNING, N. Y.—Plans for the proposed local factory building to be erected by the Hunt Glass Works, Inc., recently organized, include an electric power plant. Arland, Pratt and Pratt, Bath, are in charge.

FULTON, N. Y.—The Fulton Light, Heat & Power Company is considering extending its transmission lines into towns and villages in this vicinity, including Volney Center, Granby Center and Hinmanville, during the coming year.

GREENWICH, N. Y.—The Consolidated Electric Company has applied for authority to extend its lines into the town of Jackson, to supply electric service there.

HUNTINGTON, N. Y.—The Town Board is considering extending the Greenlawn lighting district on Jericho Turnpike from Greenlawn Avenue to Elmwood Road, and also the Larkfield lighting district on Elwood Avenue and East Elwood Avenue. The Long Island Lighting Company supplies street-lighting service here.

ROCKVILLE, CENTRE, N. Y.—At an election to be held May 3 the proposal to issue $380,000 in bonds, for rebuilding the municipal electric plant will be submitted to the voters. A bond issue of $90,000 for building a water pumping plant will be voted on at the same time.

SYRACUSE, N. Y.—The Syracuse Lighting Company is considering the erection of several hundred miles of rural electric lines to supply electricity in the rural districts.

SYRACUSE, N. Y.—Permission has been granted the Syracuse Lighting Company, Inc., to extend its electric distribution system on portions of the Onondaga Reservation and approval of a right granted by the Chiefs of the Onondaga Tribe. The company plans to erect a transmission line to supply power to the Solvay pumping station and the Jones City Stone Supply Company.

UTICA, N. Y.—New lighting districts have been established on Proctor Boulevard and Talcott Street by the City Council.

RARITAN, N. J.—The Seaboard Refractories, Company, Woodbridge Avenue, plans to build a power plant in connection with the rebuilding of its plant, recently damaged by fire, with loss of about $200,000.

TEANECK, N. J.—Plans are under way by the Board of Trustees of the Holy Name Hospital, for the construction of a power plant at the institution. Victor Reeser, 55 West Forty-second Street, New York, is architect. Teaneck has not a post office.

ERIE, PA.—Plans are under way by the City Council for building a high and low tension conduit system in East Lake Road from Hess Street to the city line.

UNIONTOWN, PA. — The West Penn Power Company, Pittsburgh, plans to build an outdoor substation in Uniontown, to cost about $175,000.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company plans extensions in its transmission line to form a new belt around the city, covering about 35 miles.

CLEAR SPRING, MD.—The Clearspring Electric Light & Power Company has applied to the Public Service Commission for authority to build a transmission line between Big Spring and Big Pool.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, D. C., until May 10, for electrical and mechanical equipment, including terminal bends, control segments, etc. (Panama Circular 1800).

North Central States

CINCINNATI, OHIO.—The installation of a new street-lighting system and signal system on Central Parkway is under consideration.

CINCINNATI, OHIO.—The construction of a substation on East Compton Road, Mount Healthy, to cost about $8,000, is under consideration by the Union Gas & Electric Company.

CLEVELAND, OHIO. — Separate bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until May 6, for subway type constant current regulators, and for "White Way" lanterns for the Division of Light and Power.

CLEVELAND, OHIO.—The Continental Terminals, Inc., care of Wilbur Watson & Associates, 4614 Prospect Avenue, engineers, is preparing plans for the construction of an ice-manufacturing and cold storage plant, at University Road and Crown Avenue, to cost about $2,000,000.

PEEBLES, OHIO.—The City Council plans to rebuild the municipal electric light and power plant, recently damaged by fire with a loss of about $25,000.

LOUISVILLE, KY. — The Louisville Hydro-Electric Company plans to build an addition to its present building at McHenry Street, Shippingport, to cost about $125,000.

LOUISVILLE, KY. — The Kentucky Utilities Company plans to build a single circuit 33,000-volt transmission line from Upton to Horse Cave, 22 miles long, add a circuit to the Elizabethtown-Upton line, extend a line 1½ miles from Upton to the Goodin Rock Crusher plant, and to build a 33,000-volt transformer station. Electric service will be extended to many rural customers and to Bonnieville. The cost of the work is estimated at $101,000.

LOUISVILLE, KY.—The installation of an ornamental lighting system on Main Street between Fifteenth and Preston Streets is under consideration by the Merchants and Manufacturers' Association.

CHICAGO, ILL.—Plans are under way for the construction of a power house and

mechanical laundry at Columbus Hospital, 2548 Lake View Avenue, to cost about $100,000. George F. Scheiber, Merchants Bank Building, Indianapolis, Ind., is engineer.

VANDALIA, ILL.—Permission has been granted the Illinois Power & Light Company, Chicago, to erect a transmission line from Vandalia to a point midway between Brownstown and Avana. Electricity will be supplied to residents along the line.

ALMA, WIS.—The Northern States Power Company, Eau Claire, contemplates the construction of an outdoor substation in connection with its local power plant.

CRIVITZ, WIS.—Steps have been taken by farmers in this locality to procure electric service from the Sandstone River Company, owned by the Wisconsin Public Service Corporation.

KAUKAUNA, WIS.—Plans are under way by the Green Bay & Mississippi Canal Company, Appleton, for the construction of a local power plant to cost about $100,000. Orbison & Orbison, Appleton, are engineers.

MENOMINEE, WIS.—Bids will be received by the trustees of the Dunn County Asylum until May 5, for construction of a new power house, laundry, coal shed and tunnel, including two 125-hp. boilers, duplicate boiler feed pumps, etc. All bids submitted on April 7 were rejected. Allan D. Conover, 26 Tenney Building, Madison, is architect and engineer.

PESHTIGO, WIS.—The Wisconsin Public Service Corporation, Green Bay is planning to erect a 2,300-volt transmission line from here to Harmony Corners, 4.3 miles long, to serve farmers along the county trunk highway D and to the residents of Harmony Corners.

RED WING, MINN. — The Northern States Power Company, Chicago, plans extensions in its transmission line from Red Wing to Vasa, Wacouta and vicinity, to furnish electric service in those localities.

SHELDON, IOWA.—At an election to be held May 4 the proposal to issue $35,000 in bonds for a municipal electric plant will be submitted to the voters. The cost of the project is estimated at $90,000.

WOODWARD, IOWA.—At an election held recently bonds to the amount of $15,000 were voted to be applied toward the establishment of a municipal electric plant. The cost of the proposed plant is estimated at $60,000.

KANSAS CITY, MO.—The street-railway power plant of the Public Service Company, located at Second Street and Grand Avenue, has been purchased by the Kansas City Power & Light Company. The latter company plans to expend between $1,500,000 and $2,000,000 in modernizing the plant and in linking it with the company's Northeast power station.

ST. LOUIS, MO.—Ordinances have been passed, by the Board of Aldermen for appropriations, totaling $1,355,000 for street-lighting installations.

ST. LOUIS, MO. — Extensions and improvements are contemplated by the Laclede Power & Light Company involving an expenditure of about $2,600,000. Improvements to the electric department will include the installation of a 12,500-kw. turbo-generator, boilers, water-cooling equipment, switchboards and extension to building in its plant at Main and Mound streets, at a cost of $498,000; also extensions to the electric distribution lines, transformers, etc., to cost about $555,000.

STANBERRY, MO.—Bonds to the amount of $30,000 have been voted to establish a municipal electric light plant.

LINCOLN, NEB.—The Lincoln Public Service Company has applied to the City Council for approval of an extension project in the newly acquired suburb of University Place.

PLATTSMOUTH, NEB. — Plans have been prepared by the Nebraska Gas & Electric Company, Lincoln, for the construction of a local substation.

Southern States

AHOSKIE, N. C.—The Town Council has approved the proposal of the Virginia Electric & Power Company, Richmond, Va., for the purchase of the municipal electric plant, subject to the approval of the voters. The contract will include the towns of Coleraine, Harrelsville, Powellsville and Winton.

MADISON, N. C.—The Southern Power Company, Charlotte, plans to erect a transmission line from Madison to Leaksville.

WINSTON-SALEM, N. C.—The Southern Public Utilities Company, Charlotte, plans to rebuild its local power plant, recently damaged by storm.

MACON, GA.—Extensions and improvements are contemplated by the Macon Railway & Light Company to cost about $300,000.

TYBEE, GA.—Bonds to the amount of $22,000 have been voted for the installation of an electric distribution system. Electricity will be supplied by the Savannah Electric & Power Company.

LAKE WALES, FLA.—The Florida Public Service Company, Orlando, plans to rebuild its power plant, recently damaged by fire, with loss of about $200,000.

PLANT CITY, FLA.—Bids will be received by the Board of Public Works until May 5 for a street-lighting system, consisting of approximately 130 ornamental lamps standards. Bids will also be received at same time for a fire-alarm system. The Bishop Engineering Company, Orlando and Plant City, is engineer.

McCOMB, MISS.—The Mississippi Central Power Company plans to extend its transmission lines from McComb to Liberty, a distance of 25 miles. The construction of a cold storage plant in Liberty is also contemplated.

CHENEYVILLE, LA.—The Louisiana Ice & Utilities Corporation, Bunkie, which has acquired the municipal electric plant, contemplates extensions in its transmission lines in this section.

NEW ORLEANS, LA.—The Lakeview Property Owners' Alliance has filed a petition with the Commission Council asking for the installation of an ornamental lighting system along West End Boulevard.

ADA, OKLA.—Bonds to the amount of $17,500 have been voted for the installation of an ornamental lighting system.

FORT WORTH, TEX.—The City Council is considering a petition for the installation of an ornamental lighting system on Pennsylvania Avenue consisting of forty-one standards mounted with lamps of 400 cp. The cost is estimated at about $11,000.

PADUCAH, TEX.—The West Texas Utilities Company, Abilene, is planning to build a large substation in Paducah in connection with its new transmission line in this section.

SONORA, TEX.—The West Texas Utilities Company, Abilene, which has acquired the municipal power plants at Sonora and El Dorado, contemplates extensions to its transmission lines in this section.

Pacific and Mountain States

EVERETT, WASH.—The Puget Sound Power & Light Company, Seattle, is considering an addition to its local substation, to cost about $25,000.

SPOKANE, WASH.—The Washington Water Power Company has applied to the Federal Power Company for a license to cover transmission lines between Fairfield and Mullen Junction, 61.7 miles long; between Mullen Junction and Crouse Gulch, 2.9 miles; between Bunker hill and Sullivan about 8 miles, and also for several other short lines.

TACOMA, WASH.—The Department of Light & Water, is planning the construction of a substation in the old Tacoma Industrial District, to cost about $35,000.

VANCOUVER, WASH.—The installation of a new street-lighting system, consisting of 216 lamps is under consideration by the City Council. The cost is estimated at $68,000.

BAKER, ORE.—In order to meet the increasing demands for electrical service in its territory the Eastern Oregon Light & Power Company has contracted with the Idaho Power Company for electrical power to be delivered at Durkee, and has contracted with the Eastern Oregon Development Company to finance and construct the necessary transmission lines and substations. The project includes the erection of a 66,000-volt transmission line, on private right of way, between Baker and Durkee, and a similar line between Baker and Union. The construction work will be under the supervision of J. P. Lottridge, Baker.

GLENDALE, CAL.—The City Council has approved the installation of an ornamental lighting system on portions of Broadview Drive and Roselawn Avenue; Sunview Drive, Arlington Avenue, and other streets, using cast iron standards.

LONG BEACH, CAL.—Plans are under way by the Southern California Edison Company, Los Angeles, for the construction of a substation at 6990 Orange Avenue.

LOS ANGELES, CAL.—The City Council has authorized the installation of ornamental lamps on Vineyard Avenue and other streets in the Vineyard Lighting District, using concrete standards.

NEWPORT BEACH, CAL.—The City Council is planning to install an ornamental lighting system in the Corona del Mar section. Paul E. Kressly, H. W. Hellman Building, Los Angeles, is city engineer.

RIVERSIDE, CAL.—The City Council has authorized plans for the installation of an ornamental lighting system on Brockton and Stewart Streets.

SAN FRANCISCO, CAL. — Property owners in the downtown shopping district have petitioned the Board of Supervisors to authorize the formation of an assessment district to provide for the establishment of a modern lighting system.

SAN FRANCISCO, CAL.—The Yosemite Power Company has applied to the Federal Power Commission for a license covering a project on the South and Middle Forks of the Toulumne River. The present plans include the construction of two reservoirs of 65,000 acre-ft. capacity, three power houses and the necessary transmission lines and conduits. It is planned to develop 51,000 hp.

TRACY, CAL.—Bids will be received by W. Schlossman, secretary of the Banta-Carbona Irrigation District, until May 11 for recording and watthour measuring instruments with transformers, clock and recording device for 66,000-volt transmission line; recording voltmeters for 2,200-volt transmission lines, one each at pump houses 1 and 4, and all necessary accessories. T. H. Means, 216 Pine Street, San Francisco, is engineer.

WILLIAMS, CAL.—The Pacific Gas & Electric Company, San Francisco, plans to install additional electric equipment at its local substation.

TUCSON, ARIZ.—The Board of Regents, University of Arizona, has appropriated $45,000, for extensions and improvements in the power plant at the institution.

ANACONDA, MONT.—The erection of an electrolytic zinc plant at Anaconda has been announced by the Anaconda Copper Mining Company. About 30,000 hp. will be required to operate the proposed plant which will be furnished by the Montana Power Company, Butte.

FORT LARAMIE, WYO.—Plans are under consideration for establishing a municipal electric plant. It is proposed to secure electricity to operate the system from the government hydro-electric plant at Lingle.

DENVER, COLO.—Bids will be received by the Bureau of Reclamation, Denver, until May 20, for two 5 x 5 ft. high pressure emergency gates, and one 72-in. circular semi-steel conduit lining for the Gibson Dam, Sun River project, Montana.

DENVER, COLO.—Bids will be received by the Bureau of Reclamation, Denver, until May 17, for eleven radial gates, and two gate hoist systems for the Riverside Canal Headworks and Sluiceway, Rio Grande project, New Mexico.

Canada

AMHERSTBURG, ONT.—The Council is considering extending the street-lighting system on several streets, to cost about $35,000.

DUNDAS, ONT.—The Dundas Rural Hydro-Electric System is considering extending its transmission lines in Ancaster and Flamboro townships, covering about 10 miles.

TIMMINS, ONT.—The erection of about 10 miles of transmission lines (wood pole) from the Sandy Falls power house on the Mattagami River to Kamiscotia, to cost about $35,000, is under consideration by the Hollinger Consolidated Gold Mines, Ltd.

TORONTO, ONT.—Tenders will be received by C. A. Magrath, chairman of the Hydro-Electric Power Commission of Ontario until June 1 for the erection of the galvanized steel iron towers for a 220,000-volt single circuit transmission line from the Ottawa River Crossing at a point near Fitzroy Harbor to the outskirts of Toronto, about 200 miles long, or for from one to four specified section or sections thereof.

QUEBEC, QUE.—The construction of three dams is under consideration by the Anglo Canadian Pulp & Paper Company. One of the proposed dams will be located on Peter Stream a branch of the Montmorency River near Beaupre, the second on the Saranne River, and the third on Peter Stream.

Electrical Patents

Announced by U. S. Patent Office

(Issued April 5, 1927)

1,623,098. CONTACT BLOCK FOR ELECTRIC ORGANS AND THE LIKE; C. N. Deverall, Buffalo, N. Y. App. filed May 17, 1922.

1,623,209. ELECTRIC MELTING POT; F. Schuster, Richmond Hill, N. Y. App. filed Dec. 16, 1925.

1,623,246. ELECTROLYTIC CELL; A. A. Jahnke, San Francisco, Cal. App. filed Aug. 20, 1925. For electrolytic decomposition of water.

1,623,249. ELECTRIC WELDING MACHINE; J. Kahn, Youngstown, Ohio. App. filed Dec. 31, 1923. Automatic butt-welding machine for connecting the sections of rolled beams by welding together the projecting tongues formed by shearing the webs of such beams along zigzag lines.

1,623,266. NOISELESS-CLOCK MECHANISM; E. S. Ostler, Chicago, Ill. App. filed July 31, 1925. Controlled by an intermittently energizable electromagnet.

1,623,323. METHOD OF INTRODUCING VOLATILE MATTER INTO LAMPS AND THE LIKE; C. C. Van Voorhis, Princeton, N. J. App. filed Aug. 18, 1923.

1,623,326. ELECTRIC SWITCH; J. Whalen, Omaha, Neb. App. filed Dec. 26, 1924. Of the mercury type; for use as a motor protective device.

1,623,332. STORAGE-BATTERY TERMINAL; R. R. Beezley, Memphis, Tenn. App. filed Aug. 3, 1922. Means for attaching external circuits without liability of doing harm to the battery jar.

1,623,344. ELECTRIC ARC-WELDING APPARATUS; H. P. Himes, Detroit, Mich. App. filed July 6, 1920. Automatic.

1,623,345. ELECTRICAL APPARATUS AND CORE THEREFOR; N. M. Hopkins, New York, N. Y. App. filed Feb. 18, 1921. Transformer adapted for use in conjunction with alternating-current rectifiers.

1,623,351. GETTER AND THE APPLICATION THEREFOR; D. MacRae, East Orange, N. J., and H. K. Richardson, Newark, N. J. App. filed June 8, 1922. For lamp filaments.

1,623,376. ANNUNCIATOR DROP; C. Auth, New York, N. Y. App. filed May 16, 1919.

1,623,434. PIPE-WELDING APPARATUS; F. P. Ofner and W. H. Nourse, Portland, Ohio. App. filed April 28, 1926. Arc-welding type.

1,623,492. ELECTRIC CURRENT REGULATOR; T. P. Peterson, Greeley, Neb. App. filed Nov. 6, 1925. Operates by automatically increasing a resistance inserted in the circuit, when the current itself is increased.

1,623,531. METHOD AND APPARATUS FOR INTERRUPTING ELECTRICAL CIRCUITS; W. Dubilier, New York, N. Y. App. filed Nov. 23, 1922. With means for dissipating the heat of the arc.

1,623,568. THERMOSTATIC CIRCUIT CONTROL; A. E. Whittier, Bristol, Conn. App. filed Sept. 4, 1925. For electrically heated apparatus, such as electric ranges.

1,623,573. EXTERNALLY OPERATED SAFETY SWITCH; T. A. Both, Stratford, Conn. App. filed July 5, 1923.

1,623,587. OUTLET BOX; O. A. Frederickson, Wethersfield, Conn. App. filed Feb. 28, 1925. For wall or ceiling mounting.

1,623,630. HAIRDRESSING APPLIANCE; T. J. Martin and J. M. Martin, New York, N. Y. App. filed Nov. 17, 1923.

1,623,654. APPARATUS USED IN BONDING RAILS AND METHOD OF ITS APPLICATION; W. P. Bovard, Mansfield, Ohio. App. filed Oct. 7, 1918.

1,623,658. CONDUCTOR SUPPORT; H. P. Chandler, Mansfield, Ohio. App. filed May 13, 1925. For a trolley-wire conductor.

1,623,665. METHOD AND APPARATUS FOR PRODUCING ALTERNATING CURRENTS; R. D. Fay, Nahant, Mass., and E. Wolf, Boston, Mass. App. filed March 15, 1922. A pole changer for producing alternating current from a direct-current source.

1,623,694. CONDUCTOR SUPPORT; S. S. Matthes, Mansfield, Ohio. App. filed Dec. 23, 1924. For trolley wires.

1,623,716. ELECTRIC CANDLE; F. N. Boss, Cranston, R. I. App. filed April 11, 1925.

1,623,719. DRY CELL; H. De Olaneta, New Haven, Conn. App. filed Aug. 18, 1920. A waterproof cell.

1,623,740. LOCK ATTACHMENT FOR ELECTRIC LAMP SOCKETS; C. F. McCann and R. A. Berrenberg, San Francisco, Cal. App. filed Aug. 17, 1925.

1,623,761. ELECTRIC LAMP; F. Skaupy, Berlin, Germany. App. filed Dec. 11, 1922. Glow lamp in which a current-conveying metallic-lighting element, which may be tungsten or the like, is mounted or spread on a suitable support.

1,623,784. INCANDESCENT FILAMENT; G. R. Fonda, Schenectady, N. Y. App. filed May 1, 1923. Consisting of tungsten in preponderating amount and containing fractional percentages of thorium and copper.

1,623,787. ELECTRIC SWITCH; J. D. Hilliard, Schenectady, N. Y. App. filed Nov. 17, 1922. Oil switch with magnetic blowout.

1,623,813. COMBINATION FIXTURE SUPPORT AND BASE; D. Schell, Myerstown, Pa. App. filed Oct. 14, 1924.

1,623,819. FUSE PLUG; O. H. Van Amburg, Bridgeport, Conn. App. filed Dec. 19, 1923. Renewable.

1,623,823. MANUALLY-CARRIED TRANSPORTING DEVICE FOR ELECTRICAL CONDUCTORS; H. A. Bittick, Taylor, Tex. App. filed July 11, 1925. Primarily for use in making night demonstrations when endeavoring to dispose of house-lighting plants for the average farmhouse.

1,623,829. ELECTRICAL APPARATUS COMPRISING A SLOW-WAVE GENERATOR; J. E. Clapp, Auburndale, Mass. App. filed March 20, 1924.

1,623,836. METAL CAP FOR ELECTRIC INCANDESCENT LAMPS AND ITS MANUFACTURE; L. P. Graner, New York, N. Y. App. filed Nov. 17, 1923.

1,623,839. CONTROL OF CHOKE COIL WITH SWITCHING-IN TAP TRANSFORMER; A. Hundt, Karlshorst, Germany. App. filed Aug. 22, 1925. Means for alternately varying the reactance of the choke coils as the switches are progressively operated.

1,623,842. AUTOMATIC PRESSURE REGULATOR; T. T. King, Fort Wayne, Ind. App. filed March 18, 1924.

1,623,846. DYNAMO-ELECTRIC MACHINE; H. T. Lang, Cleveland, Ohio. App. filed July 23, 1926. Arrangement for cooling the brush-holding spring in a small motor, as a vacuum-cleaner motor.

1,623,848. ARC LAMP; E. J. Murphy, Schenectady, N. Y. App. filed April 6, 1925. Feeding mechanism.

1,623,851. CIRCUIT INTERRUPTER; W. E. Paul, Schenectady, N. Y. App. filed July 23, 1926. Magnetic-arc blowout suitable for high-voltage service.

1,623,864. RACK; P. H. Chase, Bala, Pa., and W. Foster, Philadelphia, Pa. App. filed Jan. 28, 1926. For insulators and like fixtures.

1,623,915. MEASURING INSTRUMENT; C. E. Foster, Letchworth, England. App. filed April 29, 1924. The bearings are mounted on resilient supports, wherein they are provided with a mechanical-damping device.

1,623,920. ELECTRIFIED MONORAIL SYSTEM; F. C. Harris, Brighton, Mass. App. filed Dec. 16, 1925.

1,623,950. INDICATING DEVICE; H. R. Sargent, Bridgeport, Conn. App. filed Dec. 31, 1921. Indicating the presence or absence of an employee or a vacant seat in theaters or the like.

(Issued April 12, 1927)

1,623,954. ELECTRICAL SWITCH; H. K. Ansingh, Murraysville, Pa. App. filed Sept. 1, 1921. Plug type as used on truck-type switching equipment, etc.

1,623,955. SWITCH MECHANISM; H. K. Ansingh, Toronto, Ontario, Canada. App. filed Oct. 6, 1922. Disconnecting switch mechanism used in connection with circuit breakers of the truck-panel type.

1,624,030. FUSE PLUG AND RECEPTACLE; R. H. Williams, Evansville, Ind. App. filed April 6, 1925. Precludes the introduction of a metal conductor such as a penny, a metal strap or the like.

1,624,040. CORN POPPER; J. E. Dempsey and L. E. Burton, Johnston City, Ill. App. filed Dec. 21, 1925.

1,624,047. BATTERY CONNECTION; W. E. Gill, Lake Geneva, Wis. App. filed June 19, 1922. For connecting the electrical conducting cables to a storage battery.

1,624,059. CIRCUIT-CONTROLLING MECHANISM; J. T. Miller and M. Hanley, Chicago, Ill. App. filed Dec. 14, 1925. Adapted for use in conjunction with fire-alarm signaling systems and police signaling systems.

1,624,071. METHOD OF AFFIXING COATINGS ON INCANDESCENT-LAMP FILAMENTS; H. K. Richardson, East Orange, N. J. App. filed July 28, 1921.

1,624,076. MAGNETIC BAR POLE CHUCK; F. L. Simmons, Woonsocket, R. I. App. filed Oct. 6, 1920.

1,624,077. INCANDESCENT ELECTRIC LAMP; W. C. Sproesser, Bloomfield, N. J. App. filed Dec. 3, 1921. Means of strengthening the filament.

1,624,109. INCANDESCENT ELECTRIC LAMP; D. MacRae, East Orange, N. J. App. filed Dec. 2, 1921. With an unactivated getter on the filament and capable of activation when the lamp is initially lighted upon a commercial circuit.

1,624,131. BATTERY CASE; C. E. Bobbitt, Humboldt, Tenn. App. filed Dec. 13, 1923. Primarily for use in connection with radio apparatus.

1,624,135. ELECTRICAL MEASURING INSTRUMENT; C. E. Foster, Letchworth, England. App. filed April 16, 1925. Having a readily detachable and accurately replaceable supporting device for the angularly movable pointer or needle.

1,624,158. ELECTRICAL CONTROL SYSTEM; P. Charpentier, Paris, France. App. filed June 29, 1925. For the starting and regulation of electric traction motors or motor groups of high power and comparatively high voltage.

1,624,176. BURGLAR ALARM; T. E. O'Connor, Minneapolis, Minn. App. filed Nov. 28, 1924.

1,624,178. ALTERNATING-CURRENT METER; L. A. Paine, Toronto, Ontario, Canada. App. filed Feb. 20, 1922. To vary the capacity without the necessity of changing the current coils.

1,624,217. ELECTRIC FURNACE; F. T. Cope, Salem, Ohio. App. filed Nov. 9, 1925. Resistance type.

1,624,254. HIGH-SPEED DYNAMO-ELECTRIC MACHINE FOR CONTINUOUS CURRENT; M. Kostenko and N. Japolsky, London, England. App. filed March 19, 1923.

1,624,289. BRACE PLATE; M. Taylor, Gainesville, Ga. App. filed April 14, 1926. Means whereby transposition brackets will be securely held to the cross-arm of a telegraph pole.

1,624,314. ELECTRICAL APPARATUS; T. W. Case, Auburn, N. Y. App. filed Jan. 25, 1923. For translating sound waves into light waves.

1,624,322. FUSE; C. W. Engleman, Abilene, Kan. App. filed May 4, 1925. A fuse which is automatic in operation, thus obviating the necessity of renewing or refilling.

1,624,344. ELECTRIC FURNACE; A. D. Keene, Pittsburgh, Pa. App. filed April 2, 1924. Method of supporting electric resistor units.

1,624,345. HEATING UNIT TERMINAL; A. D. Keene, Pittsburgh, Pa. App. filed March 26, 1925.

1,624,346. TRANSFORMER-COOLING SYSTEM; C. L. Knotts, Swissvale, Pa. App. filed Sept. 10, 1924. Device that shall circulate a cooling medium at a rate varying in accordance with the temperature.

1,624,361. LIFTING TRUCK FOR CIRCUIT-BREAKER TANKS; J. W. Ow, Wilkinsburg, Pa. App. filed April 15, 1925.

1,624,364. COIL WITH MULTIPLE ADJUSTMENTS; C. D. Richard, West New Brighton, N. Y., and G. T. Morris, New York, N. Y. App. filed June 30, 1923. Inductance coil capable of both fine and coarse adjustments.

1,624,370. VOLTAGE REGULATOR; J. Slepian, Swissvale, Pa. App. filed April 21, 1924. Anti-hunting means for generator voltage regulators controlling the exciter field.

1,624,372. SWITCH LOCK; C. L. Stoeltzlen, Erie, Pa. App. filed Oct. 1, 1924. For holding disconnecting switches closed against heavy overloads.

1,624,374. SWITCHING DEVICE; A. R. Swoboda, Newark, N. J. App. filed Feb. 3, 1925. Adapted for use in portable electrical apparatus, such as telephone desk sets.

1,624,378. ALTERNATING-CURRENT MOTOR; C. A. Weber, Springfield, Mass. App. filed June 14, 1923. Of the commutator type; arrangement of the brush members.

1,624,383. MERCURY-ARC RECTIFIER; E. Beck, Pittsburgh, Pa. App. filed Dec. 4, 1924. Starting device.

1,624,387. REGULATOR SYSTEM; C. A. Boddie, Wilkinsburg, Pa. App. filed Feb. 18, 1924. In which the regulation is effected by adjustment of the field excitation.

1,624,391. ELECTRIC SWITCH; H. P. Clausen, Mamaroneck, N. Y. App. filed Nov. 9, 1923. Having a movable contact and a plurality of stationary contacts in which the movable contact may be locked in any one of its adjusted positions and readily unlocked for adjustment.

1,624,409. DRY CELL AND ELECTRODE THEREFOR; G. W. Heise, Bayside, N. Y. App. filed Dec. 31, 1923.

1,624,412. SUBMARINE SIGNALING; J. W. Horton, East Orange, N. J. App. filed Oct. 31, 1919. A sound-wave energy-translating device for underwater use.

Table I—Data on Output a

These data include al

Line No.	Company*	Rank in 1926	1926					1925		
			Peak Load Kw. (Instantaneous)	Peak Load (Est. Over Thirty-Minute Period) Kw.	Date of Instantaneous Peak	Output for Year Kw.-Hr.	Average Load in Kw. 1926	Peak Load Kw. (Instantaneous)	Peak Load (Est. Over Thirty-Minute Period) Kw.	Date of Instantaneous Peak
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	United States									
1	Buffalo, Niagara & Eastern Power Corp. (*I*)	1	687,800	682,800	Dec. 9	4,463,911,125	509,580			
2	Commonwealth Edison Company	2	897,000	867,000	Dec. 15	3,482,632,000	398,000	809,000	792,000	Dec. 23
3	Edison United & Allied Companies (*N*)	3	731,964	710 714	Dec. 20	2,554,025,704	291,555	656,312	642,907	Dec. 21
4	Southern California Edison Company	4	422,700		Nov. 9	2,227,879,772	255,004	395,900		July 22
5	Pacific Gas & Electric Company	5	406,970		Dec. 22	2,157,886,980	246,334	380,084		Nov. 4
6	Detroit Edison Company	6	439,000	(*a*) 435,000	Sept. 15	2,025,063,700	231,200	391,000	(*a*) 389,100	Oct. 2
7	Southeastern Power & Light Co. System	7	(*B*) 420,000	400,000	Oct. 8	1,966,393,998	224,210	291,000	284,000	Oct. 22
8	Philadelphia Electric Company System	8	444,000	431,500	Dec. 20	1,749,016,316	199,659	387,200	361,600	Dec. 10
9	Public Service Electric & Gas Company	9	415,000	408,000	Dec. 13	1,560,801,782	187,000	367,048	353,000	Dec. 9
10	The West Penn Electric Company	10		(*b*) 313,040	(*o*) Dec. 8	1,514,609,984	172,901			
11	Southern Power Company	11		(*c*) 337,040	(*o*) Dec. 13	1,433,759,975	163,500		(*c*) 297,705	(*o*) Jan. 12
12	Montana Power Company	12	188,400	186,900	Oct. 15	1,379,194,095	157,442	172,600	168,900	Aug. 14
13	North American Co. (Mo., Ill. & Iowa) (*P*)	13	278,121		Dec. 8	1,337,733,243	152,500	258,623		Dec. 15
14	North American Co. (Cal. Properties Sys.) (*T*)	14	251,660		July	1,334,964,749	152,500			
15	Duquesne Light Company	15	284,260		Dec. 15	1,332,033,978	152,059	271,200	264,900	Dec. 16
16	Mohawk Hudson Power Corp. System	16		251,500	Nov. 30	1,157,858,730	131,900		171,100	(*n*) Nov. 24
17	Cleveland Electric Illuminating Company	17	287,119	280,500	Dec. 15	1,118,294,193	127,555	251,375	247,000	Dec. 17
18	Ohio Power Company	18	202,000		Oct. 20	1,109,315,094	103,150		181,600	(*n*) Dec. 22
19	Appalachian Electric Power Company	19	205,000		Oct. 20	975,664,102	100,323			
20	North American Co. (Wisconsin System) (*Q*)	20	210,420		Dec. 15	959,430,412	109,500	203,904		Dec. 4
21	Pennsylvania-New Jersey Power System (*V*)	21	150,000	(*c*) 142,240	Oct. 20	937,689,159	107,000			
22	Brooklyn Edison Company, Inc	22	265,200	259,750	Dec. 21	874,023,045	99,774	228,000	223,850	Dec. 17
23	Pennsylvania Power & Light Company	23	194,402		Nov.	858,001,300	98,000	130,403		Dec.
24	Consumers Power Company	24	118,113	186,800	Nov. 9	809,134,896	92,600	157,332	155,890	Sept. 15
25	Northern States Pwr. Co. and subsidiaries	25	181,677	172,600	Dec. 6	805,380,692	91,938	168,659	160,200	Dec. 2
26	Consol. Gas, Elec. Lt. & Pwr. Co. of Balto	26		(*c*) 162,500	Dec. 21	802,768,634	91,640		(*b*) 160,700	(*o*) Dec. 21
27	Utah Power & Light Company	27	120,270		Dec.	801,444,000	91,500	112,343		Dec.
28	Great Western Power Company of Cal. (*U*)	28	143,240	141,500	Oct. 1	770,836,349	87,995	122,950		Mar. 6
29	Public Service Co. of Northern Illinois	29		(*G*) 139,809	Dec. 13	720,018,554	(*G*) 70,708	(*d*) 166,390	(*e*) 165,484	Dec. 9
30	New England Power System	30	(*c*) 179,200	185,000	(*o*) Oct. 20	716,087,950	77,800		(*c*) 165,200	(*o*) Jan. 20
31	Puget Sound Power & Light Company	31	135,665	134,600	Dec. 20	708,450,887	80,373	131,468	130,000	Dec. 10
32	Edison Elec. Illuminating Co. of Boston	32	190,276		Dec. 17	673,760,354	79,909	203,199		Dec. 1
33	Tennessee Electric Power Company	33	136,800	132,000	Jan. 12	653,812,207	74,636	155,000	142,300	Dec. 11
34	Pennsylvania Water & Power Company (*X*)	34	(*i*) 120,000	(*c*) 114,500	June 22	631,681,400	72,100	115,000	(*c*) 110,100	Nov. 13
35	San Joaquin Light & Power Corp. (*U*)	35	131,490	130,000	July 21	623,690,150	71,197	111,890	111,000	July 16
36	Union Gas & Electric Company (*C*)	36		(*a*) 162,500	(*n*) Dec. 20	574,767,060	66,332		(*h*) 145,000	
37	Washington Water Power Company	37	103,783	97,500	Dec. 22	571,833,994	65,277	107,030	98,655	Oct. 30
38	Pennsylvania-Ohio Power & Light Co	38	(*c*) 120,667	125,000	Dec. 22	543,152,601	58,662	(*i*) 100,000	94,000	
39	Ohio Public Service Company	39		(*b*) 107,400	(*o*) Jan. 15	535,078,389	(*dd*) 102,180	106,100		Dec. 2
40	Los Angeles, Bureau of Power & Light	40	121,700	120,200	Dec. 3	521,136,258	59,490	109,860	109,200	Dec. 16
41	Portland Electric Power Company	41	(*h*) 121,300	(*c*) 118,600	Dec. 17	476,272,500	54,200		(*c*) 105,500	(*o*) Dec. 18
42	U. S. War Department—Muscle Shoals	42	106,400	102,500	No. 11	439,380,300	50,157			
43	Carolina Power & Light Company	43	(*ee*) 95,000			(*ee*) 426,399,670	(*ee*) 48,700	46,000		Nov.
44	Minnesota Power & Light Co	44	86,410		Oct.	399,825,337	45,600	75,484		Oct.
45	Northern New York Utilities, Inc	45	91,500	89,700	Dec. 1	398,348,320	45,475			
46	Penn Public System (*Z*)	46	(*b*) 88,330	90,000	Nov. 23	395,333,291	45,200	84,765	76,885	Dec. 22
47	Virginia Electric & Power Company	47		82,300	(*n*) Dec. 9	377,662,174	43,114		79,440	(*n*) Dec. 15
48	Columbia Power Company	48		(*a*) 97,200		372,352,500	42,475			
49	Narragansett Electric Lighting Co	49	116,000	115,000	Dec. 20	367,579,000	42,570	94,000	92,000	Dec. 21
50	Kansas City Power & Light Company	50	79,700	(*h*) 73,200	(*m*) Oct. 19	365,170,871	43,450		(*l*) 71,000	(*n*) Dec. 4
51	Northern Ohio Power & Light Co	51		45,500		356,040,480	38,745		43,400	(*n*) Jan. 27
52	Toledo Edison Company	52	77,400	77,000	May 26	350,695,351	40,118	(*k*) 81,500	(*k*) 79,400	Oct. 21
53	Potomac Electric Power Company	53	91,500	90,000	Dec. 15	350,024,224	65,068	84,000	81,000	Dec. 16
54	Texas Power & Light Company	54	76,300		Dec.	339,468,000	38,800	57,830		Sept.
55	Central Indiana Power Company System	55	80,070	76,790	Dec. 18	334,518,201	38,187	74,800	65,000	Dec. 8
56	Rochester Gas & Electric Corp	56	77,680	(*c*) 69,100	Dec. 1	326,148,706	37,232	72,070	62,814	Dec. 21
57	Turners Falls Power & Electric Company	57	74,800	65,000	Oct. 6	321,816,370	36,800	71,800	63,500	July 2
58	Indiana & Michigan Electric Co	58	91,490		Nov. 16	318,395,010	36,311	(*b*) 58,390	60,000	(*o*) Dec. 1
59	California Oregon Power Company	59	67,040	67,040	Dec. 6	293,010,721	32,737	(*s*) 67,180	(*s*) 67,180	Oct. 20
60	Connecticut Light & Power Company	60		(*b*) 69,870	(*o*) Dec. 15	286,218,156	32,766		(*b*) 68,270	
61	Central Illinois Public Service Co	61		74,600	(*n*) Dec. 21	278,626,089	31,750	65,000	61.350	Nov. 18
62	Southern Sierras Power Company (*S*)	62	50,200		June 30-July1& 2	273,230,332	31,191	49,900		July 16
63	Public Service Co. of Colorado	63	67,080	66,000	Dec. 14	268,618,910	30,700	58,645	57,900	Dec. 22
64	Idaho Power Company	64	47,990		Aug.	266,320,000	30,400	38,555		Aug.
65	Houston Lighting & Power Company	65	56,000		Dec.	263,299,360	30,000	39,250		Dec.
66	South Carolina System (*W*)	66	58,000	(*c*) 55,100	Dec. 21	261,690,006	29,800			
67	Wisconsin Power & Light Company (*ll*)	67	62,000	60,000	Dec. 7	258,765,399	29,500			
68	Columbus Electric & Power Company	68	69,540	68,000	June 23	257,540,000	29,400	52,040	49,300	Nov. 4
69	New York & Queens Elec. Lt. & Pwr. Co. (*O*)	69	71,000	70,860	Dec. 24	255,121,687	28,140	61,300	59,312	Dec. 22
70	Interstate Public Service Company	70	57,800		Nov. 4	243,812,849	27,850			
71	Dayton Power & Light Company	71	61,400	57,000	Nov. 19	238,006,738	27,170	73,500	70,000	Dec. 21
72	Northwestern Electric Company	72	44,400		Dec.	237,403,000	27,100	39,300		Dec.
73	Seattle Lighting Department	73	64,800	60,000	Dec. 14	232,848,275	26,581	59,600	56,000	Dec. 29
74	Penn Central Light & Power Company	74	62,500	62,450	Nov. 30	227,630,419	25,668	46,300	46,250	Dec. 14
75	Northern Indiana Public Service Co. (*K*)	75		44,750	Dec. 8	227,490,211	25,969	32,796	30,500	Dec. 22
76	New Orleans Public Service, Inc	76	66,000		Dec.	222,927,000	(*gg*) 32,100	65,000		Dec.
77	Louisville Gas & Elec. Co. and subsidiaries (*Y*)	77				222,310,255	25,350	56,250	52,000	Dec. 8
78	Empire District Electric Company	78	62,280	62,000	Nov. 23	214,669,321	24,730	(*u*) 59,260		Jan. 1
79	Scranton Electric Company	79	54,020		Nov. 22	214,065,156	18,371	46,300	42,800	Aug. 6
80	Los Angeles Gas & Electric Corp	80	68,200	68,200	Dec. 23	213,459,806	24,361	58,300	58,300	Dec. 17
81	Indianapolis Light & Heat Company	81	50,200		Nov. 4	208,067,601	23,750	48,237		Dec. 16
82	Oklahoma Gas & Elec. Company	82	54,942	50,000	Nov. 29	207,140,920	23,630	45,000	40,000	Nov. 24
83	Birmingham Electric Company	83	41,692		Oct.	200,750,534	22,900	35,919		Dec.

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t and Peak Load of Largest Generati in the United States and Canad

ude all lighting, power and electric railway companies in the United States and Canada having yearly output in exces

1925			1924					1923						
ate of ntaneous Peak (11)	Output for Year Kw.-Hr. (12)	Average Load in Kw. 1925 (13)	Peak Load Kw. (Instantaneous) (14)	Peak Load (Est. Over Thirty-Minute Period) Kw. (15)	Date of Peak (16)	Output for Year Kw.-Hr. (17)	Average Load During 1924 Kw. (18)	Peak Load Kw. (19)	Peak Load (Est. Over Thirty-Minute Period Kw.) (20)	Date of Peak (21)	Output for Year Kw.-Hr. (22)	Avreage Load During 1923 Kw. (23)	Peak Load Kw. (24)	
ec. 23	3,091,424,000	353,000	717,000	697,000	Dec. 19	2,787,090,000	317,000	624,000	624,000	Dec. 4	2,573,286,711	293,756	600,000	D
ec. 21	2,262,620,409	258,290	615,283	593,727	Dec. 23	2,056,432,473	234,750	555,433	536,533	Dec. 5	1,899,679,975	217,000	497,577	D
ly 22	1,987,661,654	226,902	330,660	.....	Mar. 10	1,664,151,512	189,453	312,500	.....	Oct. 17	1,548,896,120	173,248	239,160	A
ov. 4	2,001,474,640	228,479	343,701	.....	Dec. 19	1,887,113,680	214,835	306,945	306,945	Dec. 12	1,725,619,492	196,989	293,708	N
ct. 2	1,732,420,700	197,800	335,800	333,400	Nov. 21	1,460,631,400	166,300	303,600	303,600	Dec. 5	1,360,017,300	155,300	254,700	I
t. 22	1,196,244,494	136,520	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
ec. 10	1,521,639,979	173,815	334,048	320,000	Dec. 22	1,313,297,283	154,588	299,438	289,200	Dec. 27	1,148,511,101	135,785	260,355	D
ec. 9	1,358,318,172	155,400	335,689	330,000	Dec. 22	1,198,240,840	136,800	282,654	280,500	Dec. 5	1,084,990,294	122,700	249,778	D
.....	1,316,521,920	.....	.....	.....	.....	1,196,885,215	.....	.....	.....	.....	1,140,890,776	.....	.....	
Jan. 12	1,187,872,330	135,600	.....	(o) 287,000	Dec. 16	1,054,909,770	120,000	270,800	.....	Dec. 11	1,001,026,319	114,272	233,000	
g. 14	1,234,052,127	140,485	159,150	156,500	Dec. 15	1,121,245,976	127,646	156,500	156,500	July 26	1,122,750,450	128,168	135,600	A
ec. 15	1,200,506,087	137,200	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
ec. 16	1,230,292,597	140,200	239,380	227,700	Dec. 16	1,093,939,801	124,538	219,500	.....	Nov. 20	1,063,046,267	119,477	208,980	D
Nov. 24	809,964,028	92,460	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
ec. 17	989,409,700	113,000	227,954	222,000	Dec. 10	865,079,266	98,484	187,275	184,800	Dec. 20	802,859,991	91,651	181,112	D
Dec. 22	890,509,813	101,700	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
ec. 4	849,064,272	97,100	156,179	.....	Dec. 16	595,329,699	67,800	138,291	138,291	Nov. 27	553,624,392	63,427	134,482	D
ec. 17	783,019,562	89,386	201,600	196,850	Dec. 23	684,632,824	77,941	180,000	174,000	Dec. 20	598,808,757	68,357	164,495	D
Dec.	707,995,258	80,821	135,335	.....	Dec. 22	630,923,200	72,023	116,453	.....	Nov.	602,691,800	68,800	106,987	N
pt. 15	686,548,440	78,530	146,789	144,640	Dec. 5	602,152,714	68,559	139,849	137,052	Sept. 18	574,031,472	65,529	116,130	D
ec. 2	742,601,203	84,800	156,619	152,000	Dec. 5	691,099,810	78,677	149,196	144,989	Nov. 26	636,428,456	72,652	.....	
Dec. 21	718,195,433	81,986	143,500	.....	Dec. 23	648,307,210	73,919	138,410	.....	Dec. 19	678,346,746	77,437	138,800	D
Dec.	744,186,000	84,952	105,544	.....	Dec.	749,653,000	85,500	105,452	.....	Dec.	621,977,000	71,000	87,158	D
Iar. 6	633,357,021	72,054	.....	(e) 121,800	Dec. 18	617,482,000	70,068	116,800	116,800	Dec. 12	589,597,024	65,673	105,910	D
ec. 9	(f) 615,092,925	(g) 70,216	(D) 115,392	102,392	Dec. 5	(E) 514,065,402	(i) 54,706	98,017	96,943	Dec. 4	427,460,666	48,797	82,737	D
Jan. 20	681,696,046	77,850	.....	(o) 151,200	Dec. 2	562,802,440	107,600	139,314	.....	Oct. 23	575,067,581	65,647	125,460	D
ec. 10	632,626,358	72,000	125,000	124,500	Dec. 19	607,067,218	69,000	124,300	124,300	Dec. 19	577,578,440	65,933	105,600	D
ec. 1	648,078,358	74,100	167,929	.....	Nov. 24	564,459,887	64,260	153,123	.....	Dec. 10	526,465,178	60,099	133,594	D
ec. 11	654,488,668	74,713	112,500	104,800	Dec. 10	477,593,985	54,371	93,700	97,500	Mar. 5	460,097,505	52,500	82,700	D
ov. 13	513,962,900	58,700	98,200	(o) 97,000	April 16	487,859,000	55,500	85,000	84,400	Jan. 3	420,028,600	47,900	83,000	Ju
ly 16	554,614,141	63,312	94,150	94,000	July 9	573,821,266	56,000	73,425	73,425	July 27	465,458,706	53,154	67,885	A
.....	562,408,247	64,223	(D) 125,200	.....	Dec. 17	480,219,880	61,923	112,000	107,000	Dec. 20	438,386,388	50,044	100,000	D
ct. 30	515,523,750	58,849	91,824	78,028	Dec. 19	426,053,680	47,660	86,487	84,955	Nov. 9	413,240,900	46,487	89,278	De
.....	417,368,862	47,700	75,000	69,000	.....	341,939,101	38,900	61,100	61,100	Jan. 19	340,864,488	38,911	64,200	No
ec. 2	522,063,648	59,600	121,000	(o) 110,800	Dec. 3	417,544,531	47,500	92,723	.....	Dec.	415,424,787	47,423	80,080	I
ec. 16	479,878,822	54,781	101,162	99,984	Dec. 22	437,209,701	48,104	98,945	98,096	Dec. 13	426,337,964	48,669	75,275	De
Dec. 18	421,155,600	48,000	.....	(o) 91,600	(o) Dec. 19	394,013,720	45,000	81,500	81,800	Dec. 20	365,997,750	41,780	71,800	De
Nov.	160,646,601	18,338	25,000	.....	Dec.	100,538,848	11,479	.....	.....	.....	.....	.....	.....	
Oct.	364,574,445	41,618	.....	(o) 68,375	Sept. 29	340,181,750	38,725	50,300	.....	May 22	251,144,646	28,950	.....	
ec. 22	341,630,292	39,000	69,300	66,000	Dec. 16	298,707,292	34,000	57,000	48,000	Jan.	182,281,000	20,808	.....	
Dec. 15	304,400,743	34,749	.....	58,950	Dec. 23	276,663,178	31,580	56,400	62,000	Dec. 18	262,940,313	30,000	54,250	D
ec. 21	278,445,000	31,787	.....	(o) 87,000	Feb. 14	289,626,000	33,062	88,000	.....	Nov. 21	373,505,000	42,638	85,000	D
Dec. 4	339,117,030	40,200	.....	(e) 67,723	(e) Dec. 4	315,582,737	35,925	62,800	.....	Sept. 27	289,903,699	34,450	59,490	D
Jan. 27	304,116,460	34,800	.....	(L) 47,400	Jan. 9	267,074,055	43,150	46,400	46,400	Dec. 10	259,720,216	29,100	43,000	I
ct. 21	350,518,281	(k) 42,500	77,000	77,000	Dec. 15	279,848,936	31,900	73,000	73,000	Dec. 5	273,643,372	31,238	58,000	D
ec. 16	318,700,406	36,380	77,000	74,000	Dec. 23	286,695,035	32,640	70,000	68,160	Dec. 27	269,870,850	30,807	70,000	D
Sept.	264,399,000	30,182	53,400	.....	Sept. 4	262,187,000	29,917	37,570	.....	Dec. 17	225,453,000	25,736	66,560	D
Dec. 8	262,971,086	30,050	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
ec. 21	296,678,980	33,867	62,069	(o) 56,269	Dec. 12	267,223,754	30,353	61,824	56,124	Dec. 6	248,156,900	28,330	53,040	N
uly 2	317,772,280	36,280	56,700	55,000	Nov. 8	238,574,255	27,236	59,600	59,600	June 13	217,138,000	24,800	56,400	M
Dec. 1	180,932,804	20,600	(o) 33,300	36,600	(o) Dec. 11	133,329,990	15,200	37,970	41,500	May 8	156,333,990	17,846	37,450	D
ct. 20	(t) 251,310,788	(s) 28,613	36,222	36,222	Dec. 10	180,554,058	20,000	32,463	32,463	Nov. 20	153,500,531	17,523	27,695	D
.....	287,165,218	32,800	.....	60,712	.....	227,558,428	22,602	50,900	53,450	Dec. 5	196,432,892	22,400	45,706	D
ov. 18	247,311,779	28,250	53,500	53,500	Dec. 30	202,871,998	22,100	42,300	42,300	Sept. 5	174,670,219	19,941	30,800	
ly 16	260,300,140	29,715	40,500	.....	June 7-Oct. 21	226,680,958	25,806	40,100	.....	June 11	219,653,900	25,011	36,200	Ju
ec. 22	244,055,341	27,900	55,000	52,000	Dec. 22	216,151,037	24,600	.....	.....	Dec.	145,302,874	16,587	28,800	I
Aug.	198,959,000	22,712	48,238	.....	May	218,464,000	24,939	40,016	.....	Aug.	222,590,000	25,410	38,323	Ju
Dec.	199,847,650	22,813	33,100	.....	Nov. 25	161,307,120	18,528	27,400	.....	Dec. 3	129,318,120	14,762	24,200	N
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Nov. 4	204,811,841	23,400	38,910	.....	Dec. 5	156,732,805	(i) 34,010	36,310	36,310	Oct. 16	160,246,106	18,293	.....	
ec. 22	209,748,985	23,940	48,900	46,800	Dec. 3	183,091,200	21,809	45,100	42,000	Dec. 4	160,754,592	19,201	39,500	D
ec. 21	275,502,706	31,440	72,000	68,000	Dec. 12	249,330,663	29,062	58,500	57,000	Dec. 10	196,615,340	22,444	46,500	D
Dec.	196,911,791	22,478	(B) 34,500	(o) 33,400	.....	188,771,500	20,200	30,900	31,000	Dec. 19	152,702,800	17,411	22,700	D
ec. 29	218,245,950	24,920	50,800	49,500	Dec. 9	152,125,000	17,250	35,600	34,500	Dec. 7	115,431,550	13,150	.....	
ec. 14	208,994,394	23,858	40,100	39,950	Dec. 30	165,364,793	18,761	36,100	35,700	Dec. 20	147,423,930	16,890	.....	
ec. 22	170,852,661	19,450	28,800	.....	(D) Dec. 23	149,220,978	17,000	.....	.....	.....	.....	.....	.....	
Dec.	252,735,540	28,851	56,000	55,000	Dec. 12	226,584,380	26,000	51,700	.....	Dec.	211,765,420	24,174	46,500	D
Dec. 8	217,377,479	24,400	48,700	43,100	Dec. 23	168,403,952	19,200	40,650	39,583	Dec. 5	143,749,060	16,409	35,300	N
Jan. 1	178,047,098	20,340	41,200	.....	Dec. 17	148,402,996	17,143	58,826	.....	May	152,681,540	17,400	.....	
Aug. 6	197,864,432	22,620	.....	39,800	Dec. 23	164,162,797	18,700	.....	.....	.....	.....	.....	.....	
ec. 17	184,683,171	21,069	69,000	69,000	Nov. 5	245,047,430	27,883	43,500	43,500	Dec. 18	127,357,201	14,563	.....	
ec. 16	196,762,929	22,470	45,544	45,544	Dec. 18	181,810,339	20,754	39,478	39,478	May 8-11	169,453,319	19,350	38,326	D
ov. 24	156,979,298	17,930	36,456	32,000	Nov. 15	129,946,323	18,100	30,850	.....	Dec.	108,364,544	.....	.....	
Dec.	224,109,866	25,582	37,749	.....	Dec. 10	193,987,141	22,144	35,202	.....	Dec. 5	162,443,207	18,544	.....	
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Supplement to ELECTRICAL WORLD, April 30, 1927

k Load of Largest Generating and D
he United States and Canada

lectric railway companies in the United States and Canada having yearly output in excess of 100,000,000 kw.-hr. duri

1924					1923					1922				
Load Kw. stan- eous) (14)	Peak Load (Est. Over Thirty-Minute Period) Kw. (15)	Date of Peak (16)	Output for Year Kw.-Hr. (17)	Average Load During 1924 Kw. (18)	Peak Load Kw. (19)	Peak Load (Est. Over Thirty-Minute Period Kw.) (20)	Date of Peak (21)	Output for Year Kw.-Hr. (22)	Avreage Load During 1923 Kw. (23)	Peak Load Kw. (24)	Date of Peak Load (25)	Output for Year Kw.-Hr. (26)	Peak Load Kw. (27)	Da Pe Lo (2
17,000	697,000	Dec. 19	2,787,090,000	317,000	624,000	624,000	Dec. 4	2,573,286,711	293,756	600,000	Dec. 12	2,225,442,875	525,640	Dec
15,283	593,727	Dec. 23	2,056,432,473	234,750	555,433	536,533	Dec. 5	1,899,679,975	217,000	497,577	Dec. 20	1,659,269,781	422,721	Dec
30,660	.....	Mar. 10	1,664,151,512	189,453	312,500	.....	Oct. 17	1,548,896,120	173,248	239,160	Aug. 28	1,198,926,369	238,480	Dec
43,701	.....	Dec. 19	1,887,113,680	214,835	306,945	306,945	Dec. 12	1,725,619,492	196,989	293,708	Nov. 10	1,608,940,735	265,925	Nov
35,800	333,400	Nov. 21	1,460,631,400	166,300	303,600	303,600	Dec. 5	1,360,017,300	155,300	254,700	Dec. 7	1,105,211,100	201,500	Nov
34,048	320,000	Dec. 22	1,313,297,283	154,588	299,438	289,200	Dec. 27	1,148,511,101	135,785	260,355	Dec. 14	956,910,225	213,570	Dec
35,689	330,000	Dec. 22	1,198,240,840	136,800	282,654	280,500	Dec. 5	1,084,990,294	122,700	249,778	Dec. 18	958,407,194	213,502	Nov
.....	.....	.....	1,196,885,215	.....	.....	.....	.....	1,140,890,776	.....	.....	.....	.....	.....	.....
.....	(o) 287,000	Dec. 16	1,054,909,770	120,000	270,800	.....	Dec. 11	1,001,026,319	114,272	233,000	July	910,488,432	218,300	Fe
59,150	156,500	Dec. 15	1,121,245,976	127,646	156,500	156,500	July 26	1,122,750,450	128,168	135,600	Aug. 10	963,662,660	116,600	Jan
39,380	227,700	Dec. 16	1,093,939,801	124,538	219,500	.....	Nov. 20	1,063,046,267	119,477	208,980	Dec. 13	858,329,336	164,240	Fe
27,954	222,000	Dec. 10	865,079,266	98,484	187,275	184,800	Dec. 20	802,859,991	91,651	181,112	Dec. 14	688,149,162	141,850	Dec
56,179	.....	Dec. 16	595,329,699	67,800	138,291	138,291	Nov. 27	553,624,392	63,427	134,482	Dec. 19	458,405,215	98,887	Nov
01,600	196,850	Dec. 23	684,632,824	77,941	180,000	174,000	Dec. 20	598,808,757	68,357	164,495	Dec. 7	516,987,870	137,800	Dec
35,335	.....	Dec. 22	630,923,200	72,023	116,453	.....	Nov.	602,691,800	68,800	106,987	Nov. 14	495,344,612	84,203	Sept
46,789	144,640	Dec. 5	602,152,714	68,559	139,849	137,052	Sept. 18	574,031,472	65,529	116,130	Dec. 4	461,840,561	95,410	Dec
56,619	152,000	Dec. 5	691,099,810	78,677	149,196	144,989	Nov. 26	636,428,456	72,652	.....	.....	.....	.....	.....
43,500	.....	Dec. 23	648,307,210	73,919	138,410	.....	Dec. 19	678,346,746	77,437	138,800	Dec. 13	568,669,404	108,330	Nov
05,544	.....	Dec.	749,653,000	85,500	105,452	.....	Dec.	621,977,000	71,000	87,158	Dec. 19	428,912,903	75,661	Jan
.....	(e) 121,800	Dec. 18	617,482,000	70,068	116,800	116,800	Dec. 12	589,597,024	65,673	105,910	Dec. 5	572,693,958	95,540	Jun
15,392	102,392	Dec. 5	(E) 514,065,402	(i) 54,706	98,017	96,943	Dec. 4	427,460,666	48,797	82,737	Dec. 19	362,220,201	80,563	Dec.
.....	(o) 151,200	Dec. 2	562,802,440	107,600	139,314	.....	Oct. 23	575,067,581	65,647	125,460	Dec. 14	469,993,180	112,200	Nov
25,000	124,500	Dec. 19	607,067,218	69,000	124,300	124,300	Dec. 19	577,578,440	65,933	105,600	Dec. 4	474,042,886	99,800	De
67,929	.....	Nov. 24	564,459,887	64,260	153,123	.....	Dec. 10	526,465,178	60,099	133,594	Dec. 14	439,448,099	128,200	Dec.
12,500	104,800	Dec. 10	477,593,985	54,371	93,700	97,500	Mar. 5	460,097,505	52,500	82,700	Dec. 11	353,320,559	69,100	May
98,200	(o) 97,000	April 16	487,859,000	55,500	85,000	84,400	Jan. 3	420,028,600	47,900	83,000	June 10	373,341,800	83,000	No
94,150	94,000	July 9	573,821,266	56,000	73,425	73,425	July 27	465,458,706	53,154	67,885	Aug. 4	451,390,040	61,700	Jun
25,200	.....	Dec. 17	480,219,880	61,923	112,000	107,000	Dec. 20	438,386,388	50,044	100,000	Dec. 13	366,071,350	75,000	Dec. 14
91,824	78,028	Dec. 19	426,053,680	47,660	86,487	84,955	Nov. 9	413,240,900	46,487	89,278	Dec. 12	407,657,100	70,110	Nov
75,000	69,000	.....	341,939,101	38,900	61,100	61,100	Jan. 19	340,864,488	38,911	64,200	Nov. 20	276,936,464	45,300	Nov
21,000	(o) 110,800	Dec. 3	417,544,531	47,500	92,723	.....	Dec.	415,424,787	47,423	80,080	Nov.	316,838,000	.....	.....
01,162	99,984	Dec. 22	437,209,701	48,104	98,945	98,096	Dec. 13	426,337,964	48,669	75,275	Dec. 15	318,502,702	51,900	Dec.
.....	(o) 91,600	(o) Dec. 19	394,013,720	45,000	81,500	81,800	Dec. 20	365,997,750	41,780	71,800	Dec. 28	324,116,190	64,800	Dec.
25,000	.....	Dec.	100,538,848	11,479	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	(o) 68,375	Sept. 29	340,181,750	38,725	50,300	.....	May 22	251,144,646	28,950	.....	.....	.....	.....	.....
69,300	66,000	Dec. 16	298,707,292	34,000	57,000	48,000	Jan.	182,281,000	20,808	.....	.....	.....	.....	.....
.....	58,950	Dec. 23	276,663,178	31,580	56,400	62,000	Dec. 18	262,940,313	30,000	54,250	Dec. 18	230,293,745	47,000	Dec.
.....	(o) 87,000	Feb. 14	289,626,000	33,062	88,000	.....	Nov. 21	373,505,000	42,638	85,000	Dec. 4	297,400,000	72,000	Nov
.....	(e) 67,723	(e) Dec. 4	315,582,737	35,925	62,800	.....	Sept. 27	289,903,699	34,450	59,490	Dec. 6	253,305,000	50,531	Dec.
.....	(L) 47,400	Jan. 9	267,074,055	43,150	46,400	46,400	Dec. 10	259,720,216	29,100	43,000	Dec.	232,684,874	42,000	Oct.
77,000	77,000	Dec. 15	279,848,936	31,900	73,000	73,000	Dec. 5	273,643,372	31,238	58,000	Dec. 14	215,785,945	46,700	Dec.
77,000	74,000	Dec. 23	286,695,035	32,640	70,000	68,160	Dec. 27	269,870,850	30,807	70,000	Dec. 20	251,984,618	65,000	Dec.
53,400	.....	Sept. 4	262,187,000	29,917	37,570	.....	Dec. 17	225,453,000	25,736	66,560	Dec. 13	183,536,613	33,620	Sept.
62,069	(o) 56,269	Dec. 12	267,223,754	30,353	61,824	56,124	Dec. 6	248,156,900	28,330	53,040	Nov. 23	193,503,573	48,734	Dec.
56,700	55,000	Nov. 8	238,574,255	27,236	59,600	59,600	June 13	217,138,000	24,800	56,400	May 16	201,796,000	57,900	May
33,300	36,600	(o) Dec. 11	133,329,990	15,200	37,970	41,500	May 8	156,333,990	17,846	37,450	Dec. 4	136,825,060	28,280	Dec.
36,222	36,222	Dec. 10	180,554,058	20,000	32,463	32,463	Nov. 20	153,500,531	17,523	27,695	Dec. 20	131,293,165	20,270	Marc
.....	60,712	.....	227,558,428	22,602	50,900	53,450	Dec. 5	196,432,892	22,400	45,706	Dec. 14	158,371,247	28,255	Nov.
53,500	53,500	Dec. 30	202,871,998	22,100	42,300	42,300	Sept. 5	174,670,219	19,941	30,800	Oct.	128,345,120	26,300	De
40,500	.....	June 7-Oct. 21	226,680,958	25,806	40,100	.....	June 11	219,653,900	25,011	36,200	July 14	186,671,850	45,700	June 6 &
55,000	52,000	Dec. 22	216,151,037	24,600	.....	.....	Dec.	145,302,874	16,587	28,800	Dec.	102,631,000	.....	.....
48,238	.....	May	218,464,000	24,939	40,016	.....	Aug.	222,590,000	25,410	38,323	July 24	212,237,000	35,635	Sept
33,100	.....	Nov. 25	161,307,120	18,528	27,400	.....	Dec. 3	129,318,120	14,762	24,200	Nov. 22	.....	.....	.....
38,910	.....	Dec. 5	156,732,805	(i) 34,010	36,310	36,310	Oct. 16	160,246,106	18,293	.....	.....	.....	.....	.....
48,900	46,800	Dec. 3	183,091,200	21,809	45,100	42,000	Dec. 4	160,754,592	19,201	39,500	Dec. 13	136,850,900	32,500	Dec
72,000	68,000	Dec. 12	249,330,663	29,062	58,500	57,000	Dec. 10	196,615,340	22,444	46,500	Dec. 8	159,836,687	37,500	Nov.
34,500	(o) 33,400	.....	188,771,500	20,200	30,900	31,000	Dec. 19	152,702,800	17,411	22,700	Dec. 29	120,698,840	22,190	Dec.
50,800	49,500	Dec. 9	152,125,000	17,250	35,600	34,500	Dec. 7	115,431,550	13,150	.....	.....	.....	.....	.....
40,100	39,950	Dec. 30	165,364,793	18,761	36,100	35,700	Dec. 20	147,423,930	16,890	.....	.....	.....	.....	.....
28,800	.....	(D) Dec. 23	149,220,978	17,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
56,000	55,000	Dec. 12	226,584,380	26,000	51,700	.....	Dec.	211,765,420	24,174	46,500	Dec. 13	188,000,000	.....	.....
48,700	43,100	Dec. 23	168,403,952	19,200	40,650	39,583	Dec. 5	143,749,060	16,409	35,300	Nov. 15	120,011,093	.....	.....
41,200	.....	Dec. 17	148,402,996	17,143	58,826	.....	May	152,681,540	17,400	.....	.....	.....	.....	.....
.....	39,800	Dec. 23	164,162,797	18,700	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
69,000	69,000	Nov. 5	245,047,430	27,883	43,500	43,500	Dec. 18	127,357,201	14,563	.....	.....	.....	.....	.....
45,544	45,544	Dec. 18	181,810,339	20,754	39,478	39,478	May 8-11	169,453,319	19,350	38,326	Dec. 14	138,356,280	29,350	Nov
36,456	32,000	Nov. 15	129,946,323	18,100	30,850	.....	Dec.	108,364,544	.....	.....	.....	.....	.....	.....
37,749	.....	Dec. 10	193,987,141	22,144	35,202	.....	Dec. 5	162,443,207	18,544	.....	.....	.....	.....	.....
.....	.....	Dec. 19	147,218,203	16,757	29,600	29,600	Dec. 7	136,237,000	15,611	31,000	Dec. 8	113,144,832	29,400	Dec.

Distributing Companies

r. during 1926

1921			1920		1919			1918			
	Date of Peak Load (28)	Output for Year Kw.-Hr. (29)	Peak Load Kw. (30)	Date of Peak Load (31)	Output for Year Kw.-Hr. (32)	Peak Load Kw. (33)	Date of Peak Load (34)	Output for Year Kw.-Hr. (35)	Peak Load Kw. (36)	Date of Peak Load (37)	Output for Year Kw.-Hr. (38)	Line No. (39)
												1
0	Dec. 21	1,928,271,943	478,820	Dec. 17	1,883,570,000	428,630	Dec. 15	1,883,570,000	400,010	Dec. 2	1,508,070,000	2
1	Dec. 14	1,475,276,053	398,535	Dec. 6 & 22	1,383,070,086	330,210	Nov. 25	1,104,521,883	286,103	Dec. 11	958,878,156	3
0	Dec. 13	1,224,718,196	213,450	July 12	1,079,474,091	200,020	July 23	1,021,977,519	163,125	July 12	779,758,000	4
5	Nov. 29	1,489,088,657	259,004	Dec. 22	1,475,678,673	187,135	Dec. 19	994,557,418	166,705	June 4	922,037,604	5
0	Nov. 23	897,980,200	218,800	June 16	1,002,306,000	210,000	Dec. 5	872,583,200	172,000	Dec. 13	773,876,700	6
												7
0	Dec. 8	877,047,595	203,624	Nov. 23	910,327,693	199,247	Dec. 18	722,615,280	166,294	Dec. 6	693,447,962	8
2	Nov. 28	821,198,975	216,452	Nov. 16	912,899,972	207,890	Dec. 16	821,355,239	185,738	Dec. 5	795,481,279	9
												10
0	Feb.	790,000,000	210,000	Nov.	745,873,992	196,500						11
0	Jan. 1	572,277,989	159,700	Aug. 7	1,103,620,644	133,500	June 13	865,998,552	157,800	Nov. 21	1,108,125,350	12
												13
												14
0	Feb.	702,897,985	162,000	Jan. 29	810,401,406	157,900	Dec. 22	623,000,000	141,000	Dec. 6	741,874,585	15
												16
0	Dec. 15	564,819,267	155,041	Sept. 9	682,557,097	153,878	Dec. 5	576,131,649	128,319	Nov. 22	543,663,042	17
												18
												19
7	Nov. 22	375,354,892	90,347	Jan. 6	398,619,744	97,912	Dec. 4	331,874,192	87,855	Nov. 20	327,784,516	20
												21
0	Dec. 6	438,887,775	116,500	Nov. 30	382,963,027	105,400	Jan. 15	327,084,075	86,000	Dec. 11	282,424,822	22
3	Sept. 27	442,507,974	87,685	Sept.	411,639,501							23
0	Dec. 12	397,815,027	106,924	May 19	476,095,098	108,847	Nov. 28	456,230,164	98,666	Nov. 21	404,412,000	24
												25
0	Nov. 30	415,335,614	88,990	Nov. 30	429,710,847	80,640	Dec. 5	392,201,280	82,760	Nov. 7	433,196,550	26
1	Jan. 8	362,908,000	85,404	Nov.	519,854,000	79,725	Jan. 14	461,532,000	81,313	Dec. 27	533,044,000	27
0	June 7	490,584,257	80,600	July 27	408,577,754	84,860	Aug. 1	453,353,358	75,480	Aug. 12	451,309,000	28
8	Dec. 30	415,940,095										29
0	Nov. 9	405,979,457	103,450	Jan. 6	430,918,000	93,860	Dec. 9	357,303,224	76,900	Dec. 16	323,127,784	30
0	Dec.	419,197,581	95,725	Dec. 3	472,765,800	93,900	Dec. 18	452,209,000	88,230	Dec. 20	427,800,000	31
0	Dec. 15	375,025,955	105,090	Dec. 9	395,076,738	103,136	Dec. 8	328,798,850	95,774	Dec. 6	293,966,604	32
0	May 16	342,948,926	74,800	April 3 & June 4	482,649,835	82,300	Feb. 14	422,272,590	87,800	Dec. 11	519,959,383	33
0	Nov.	419,987,000	85,000		494,624,000	87,000	Nov.	512,138,100	89,000	Feb.	500,641,122	34
0	June 27	396,174,690	47,180	Aug. 28	299,536,000							35
0	Dec. 14 & 23	281,537,273	65,050	Dec. 21	234,634,375							36
0	Nov. 23	374,378,300	63,955	Jan. 21	351,087,900	63,220	Dec. 3	241,761,350	33,956	Nov. 26	195,628,500	37
0	Nov. 9	202,670,200	48,900	Nov. 3	255,537,150							38
												39
0	Dec. 21	300,353,806	46,500	Dec. 29	169,489,210							40
0	Dec. 20	298,514,571	62,600	Dec. 6	292,318,971	56,300	Dec. 22	271,600,300	56,900	Dec. 23	258,424,940	41
												42
												43
												44
												45
												46
0	Dec. 14	208,323,000	46,150	Dec. 22	208,517,000	42,800	Dec. 18	125,840,000	35,700	Dec. 18	164,810,750	47
												48
0	Nov. 23	243,087,000	54,000	Jan. 5 & Nov. 6	213,232,000	57,000	Dec. 23	155,678,890	45,000	June 20	150,028,780	49
1	Dec. 23	204,752,604	35,500	Dec. 23	175,939,618							50
0	Oct. 12	187,249,647	44,400	May	247,109,963							51
0	Dec. 13	179,121,428	52,400	March	207,830,610	48,220	Dec.	199,771,799	40,305	Dec.	161,103,970	52
0	Dec. 14	238,028,571	62,000	Nov. 30	225,994,701	55,000	Dec. 17	204,008,647	48,000	Dec. 20	173,180,014	53
0	Sept. 22	156,861,213	33,620	Oct. 14	159,939,831							54
												55
4	Dec. 16	185,480,692	49,400	Oct. 29	193,601,590	42,500	Dec. 2	172,892,249	52,300	Nov. 22	196,171,300	56
0	May 17	170,826,000	55,500	May 27	212,126,530							57
0	Dec. 16	105,593,490	27,130	Nov. 9	103,693,910							58
0	March 16	133,091,607	20,335	Jan. 28	143,025,818							59
5	Nov. 28	101,129,915	33,392	Oct. 12	145,111,822							60
0	Dec.	114,587,986										61
0	June 6 & Aug. 8	199,453,965	32,600	July 23	175,104,808	29,200		165,782,785	28,200	Aug. 6	161,347,690	62
												63
5	Sept. 1	190,215,255	34,235	July	184,843,000							64
												65
												66
												67
												68
0	Dec. 7	112,472,748										69
												70
0	Nov. 28	134,588,457	31,500	May 25 & Sept. 28	129,618,270							71
0	Dec. 12	113,913,335	20,600	Dec. 10	112,736,089							72
												73
												74
												75
												76
												77
						32,030	Oct.	130,114,100	25,400	Sept. 5	114,446,685	78
												79
												80
0	Nov. 9	108,829,278	27,240	Sept. 15	114,416,090							81
												82
												83
0	Dec. 20	95,607,600	22,700	Nov. 10	120,598,174							84

66	South Carolina System (*W*)	66	58,000	(*c*) 55,100	Dec. 21	261,690,006	29,800				
67	Wisconsin Power & Light Company (*U*)	67	62,000	60,000	Dec. 7	258,765,399	29,500				
68	Columbus Electric & Power Company	68	69,540	68,000	June 23	257,540,000	29,400	52,040	49,300	Nov. 4	
69	New York & Queens Elec. Lt. & Pwr. Co. (*O*)	69	71,000	70,860	Dec. 24	255,121,687	28,140	61,300	59,312	Dec. 22	
70	Interstate Public Service Company	70	57,800		Nov. 4	243,812,849	27,850				
71	Dayton Power & Light Company	71	61,400	57,000	Nov. 19	238,006,738	27,170	73,500	70,000	Dec. 21	
72	Northwestern Electric Company	72	44,400		Dec.	237,403,000	27,100	39,300		Dec.	
73	Seattle Lighting Department	73	64,800	60,000	Dec. 14	232,848,275	26,581	59,600	56,000	Dec. 29	
74	Penn Central Light & Power Company	74	62,500	62,450	Nov. 30	227,630,419	25,668	46,300	46,250	Dec. 14	
75	Northern Indiana Public Service Co. (*K*)	75		44,750	Dec. 8	227,490,211	25,969	32,796	30,500	Dec. 22	
76	New Orleans Public Service, Inc.	76	66,000		Dec.	222,927,000	(*gg*) 32,100	65,000		Dec.	
77	Louisville Gas & Elec. Co. and subsidiaries (*Y*)	77				222,310,255	25,350	56,250	52,000	Dec. 8	
78	Empire District Electric Company	78	62,280	62,000	Nov. 23	214,669,321	24,730	(*u*) 59,260		Jan. 1	
79	Scranton Electric Company	79	54,020		Nov. 22	214,065,156	18,371	46,300	42,800	Aug. 6	
80	Los Angeles Gas & Electric Corp.	80	68,200	68,200	Dec. 23	213,459,806	24,361	58,300	58,300	Dec. 17	
81	Indianapolis Light & Heat Company	81	50,200		Nov. 4	208,067,601	23,750	48,237		Dec. 16	
82	Oklahoma Gas & Elec. Company	82	54,942	50,000	Nov. 29	207,140,920	23,630	45,000	40,000	Nov. 24	
83	Birmingham Electric Company	83	41,692		Oct.	200,750,534	22,900	35,919		Dec.	
84	Tacoma Light Department	84	55,000	40,300	Oct. 11	195,791,000	22,000	33,000	32,500	Dec. 29	
85	Kansas Gas & Electric Company	85	44,400		Dec.	194,417,500	22,200	35,800		Dec.	
86	Hartford Electric Light Company	86	67,000	(*hh*) 67,000	Aug. 26	192,253,000	26,000	56,400	52,000	May 1	
87	Nebraska Power Company	87	38,800		Sept. 22	187,052,800	21,350	30,500		Oct.	
88	Central Maine Power Company	88		(*c*) 43,800	(*o*) Dec. 17	183,268,485	20,921	(*r*) 628,410		(*v*) Dec.	
89	East Penn Electric Company	89	33,366			176,135,500	20,100				
90	Florida Power & Light Company	90	64,000		Feb.	173,623,725	19,900				
91	New Bedford Gas & Edison Light Co.	91	52,600	50,000	Dec. 20	172,222,651	19,860	50,300	49,000	Dec. 1	
92	Pacific Power & Light Company	92	27,677		Dec.	166,214,470	19,000	(*i*) 35,000		Aug.	
93	Illinois Electric Power Company	93	43,000	42,000	Aug. 20	165,088,310	19,400				
94	Cleveland Municipal Elec. Light System	94				164,932,820	18,800		31,000	Dec. 21	
95	Oil Belt Power Company	95	23,600		Dec.	163,872,000	18,700	23,300		Dec.	
96	Dallas Power & Light Company	96	35,100		Nov.	159,430,750	18,200	36,400		Dec.	
97	Fort Worth Power & Light Company	97	51,500		Dec.	155,794,457	17,800	51,500		Dec.	
98	Blackstone Valley Gas & Electric Co.	98		(*b*) 51,792	(*o*) Nov. 30	153,976,958	17,577	48,000	46,700	Dec. 21	
99	Arkansas Power & Light Company	99	43,500		Dec.	151,908,790	17,300				
100	Wisconsin Public Service Corp.	100		(*c*) 33,200	(*o*) Nov. 17	150,635,115	29,067	30,400	29,000	Dec. 4	
101	Michigan Northern Power Company	101				150,060,345	24,666		(*q*) 33,084	(*n*) Aug. 2	
102	Kentucky Utilities Company	102	(*i*) 34,100	(*i*) 34,100	(*i*) Dec. 21	146,560,259	16,700				
103	Memphis Power & Light Company	103	36,392		Dec.	137,786,000	15,700	34,300		Dec.	
104	Kentucky & West Virginia Power Company	104	10,000		April 13	137,256,705	4,679				
105	Western States Gas & Electric Co.	105				128,836,865	18,021	36,244	32,602		
106	Merchants Heat & Light Company	106	28,100		Dec. 9	128,322,613	14,649				
107	Des Moines Electric Light Company	107	32,000	31,000	Nov. 8	128,293,150	13,800				
108	Westchester Lighting Company (*O*)	108	(*A*) 32,980	(*A*) 32,430	Dec. 15	(*A*) 126,197,021	(*A*) 14,445	(*A*) 30,000	(*A*) 28,100	Dec. 21	
109	Edison Electric Company (Lancaster)	109		(*c*) 28,850		125,911,263	14,373	(*x*) 30,300		(*y*)	
110	Moline-Rock Island Mfg. Company	110	32,530	32,000	Sept. 14	124,713,651	14,237	30,000	28,000	Dec. 4	
111	Indiana Service Corp.	111	32,900	31,500	Dec. 13	123,632,339	14,110				
112	San Diego Consol. Gas & Electric Co.	112	31,900	31,000	Nov. 1	123,369,160	13,400	27,300	26,000	Dec. 18	
113	Louisiana Power Company	113	34,000		Dec.	122,937,000	14,000				
114	Central Illinois Light Company	114	28,600	27,500	Dec. 21	117,679,234	13,000	25,800	(*m*) 24,897	Sept. 30	
115	United Illuminating Co., Bridgeport, Conn.	115	31,000	30,600	Nov.	115,535,700	26,000				
116	Salt River Valley Water Users' Association	116	24,750		Sept. 3	113,107,669	(*bb*)				
117	United Elec. Lt. Co., Springfield, Mass.	117	35,830		Jan. 18	109,818,700	12,538				
118	Atlantic City Electric Company	118	29,000		Sept. 4	106,141,300	12,111				
119	Worcester Electric Light Company	119	32,500	30,000	Dec. 13	105,039,000	11,991	38,900	31,200	Feb. 4	
120	Indiana General Service Company	120	23,140		Dec. 8	104,648,573	11,644				
121	Southern Colorado Power Company	121	20,071	20,071	July 9	102,206,910	11,990				
122	Staten Island Edison Corp.	122	31,500	(*c*) 30,000	Feb. 19 & 23	100,957,540	11,525				
123	Tampa Electric Company	123		27,620	Dec. 7	100,462,550	11,468				
124	Gulf States Utilities Company	124	(*i*) 22,000	20,000	(*aa*) Dec. 2	100,344,073	11,455				
	Total† (*ii*)					66,772,261,605†					
	Canada										
125	Hydro-Electric Power Com. of Ontario (*R*)	1	711,220	(*ff*) 704,042	Nov. 19	3,867,398,041	441,483	635,485	(*O*) 628,985	Dec. 8	
126	Shawinigan Water & Power Company	2	392,330	392,330	Dec. 9	2,557,613,443	292,000	371,002	371,002	Nov. 24	
127	Montreal Light, Heat & Power Consol.	3	252,000	252,000	Nov. 22	1,251,502,612	142,800	233,230	233,230	Dec. 9	
128	West Kootenay Power & Light Co., Ltd.	4		63,300		410,327,600	46,820				
129	British Columbia Electric Ry. Co., Ltd. (*F*)	5	79,000	77,200	Dec. 16	333,654,900	38,088	83,100	78,400	Dec. 22	
130	City of Winnipeg Hydro-Electric System	6	70,844	68,144	Dec. 20	324,993,710	37,100	60,321	59,480	Dec. 31	
131	Winnipeg Electric Company (*J*)	7	66,200	62,200	Dec. 1	285,508,300	32,592	61,100	56,100	Jan.	
132	Dominion Power & Transmission Co., Ltd.	8	53,200	53,200	Dec. 15	241,355,956	21,105				
133	Ottawa & Hull Power Company (*H*)	9	42,250	39,860	Dec. 2	177,990,960	20,319				
134	Kaministiqua Power Company, Ltd.	10	26,700	(*p*) 26,000	Nov. 26	144,638,800	16,500	28,000	25,300	Sept. 30	
	Total (*jj*)					9,594,984,322					
	Mexico										
135	The Mexican Light & Power Co., Ltd.			99,644		594,046,265	67,748		98,991		
	Electric Railways										
136	Interborough Rapid Transit Company	1		283,600	Jan. 28	1,063,717,242	121,224		276,380	Jan. 23	
137	Chicago Surface Lines	2	264,000	(*c*) 198,463	Dec. 14	(*cc*) 581,706,072	(*cc*) 72,666	(*i*) 200,000	(*o*) 185,319	Feb. 27	
138	Williamsburgh Power Plant Corp. (B.M.T.)	3	(*o*) 138,100	142,000	Jan. 29	542,141,625	61,888	(*o*) 132,300	138,000	Dec. 23	
139	Philadelphia Rapid Transit Co.	4		120,290	Jan. 28	390,915,742	44,625		116,160	Jan. 28	
140	Pennsylvania Railroad Company (L. I.)	5	(B) 88,800			286,533,764	(*G*) 27,350	98,000	79,600	Jan. 2	
140	Boston Elevated Railway Company	6	94,490	90,195	Jan. 29	257,696,595	29,417	94,226	89,943	Jan. 28	
142	New York, New Haven & Hartford R.R.	7	(*G*) 43,000	(*Gc*) 32,700	Dec. 16	209,658,870	(*G*) 14,594	40,000	(*o*) 31,300	Dec. 10	
143	New York Central Railroad Company	8	73,000	(*b*) 63,680	Dec. 27	205,649,608	22,800	(*i*) 70,000	(*o*) 60,310	Dec. 28	
144	Pacific Electric Railway Company	9	52,000	46,000	Dec. 22	187,975,148	21,460	(*o*) 44,000	50,000	Dec. 15	
145	Twin City Rapid Transit Company	10		48,428	(*n*) Jan. 19	140,216,985	16,007		24,460		
146	Chicago, Milwaukee & St. Paul Railway	11				(*kk*) 138,083,293					
147	Kansas City Public Service Co.	12	45,000	42,600	Dec. 15	131,186,730	14,976	43,000	40,500	Jan. 27–Dec.	
148	The Connecticut Company	13		(*b*) 25,450	(*o*) Feb. 10	115,769,700	13,200				
149	Wilmington & Philadelphia Traction Co.	14	22,500		Aug. 13	111,341,210	11,263				
150	Norfolk & Western Railway Company	15	38,500	27,000	Oct. 30	106,426,752	12,263				
	Total					4,469,019,336					

*Companies previously reported separately, with names of companies or systems in which their operations are now included

Appalachian Power Co.—Appalachian Electric Pwr. Co. (19).

Buffalo General Electric Company—Buffalo, Niagara & Eastern Power Corp. (1).

Consolidated Power & Light Company—Appalachian Electric Power Company (19).

Georgia Railway & Power Company—Southeastern Power & Light Company System (7).

Metropolitan Edison System—Pennsylvania-New Jersey System (21).

Metropolitan Power Company—Pennsylvania-New Jersey System (21).

Niagara Falls Power Company—Buffalo, Niagara & Eastern Pwr. Corp. (1).

Niagara, Lockport & Ontario Pwr. Co.—Buffalo, Niagara & Eastern Pwr. Corp. (1).

Northern Indiana Gas & Elec. Co.—Northern Indiana Public Service Co. (75).

North West Utilities Co. (Holding Co.)—Wisconsin Power & Light Co. (in part) (67).

Potomac Edison Company—The West Penn Electric Company (10).

Syracuse Lighting Company—Mohawk Hudson Power Corporation System (16).

United Light & Power Co. (Holding Co.)—Principal contiguous operations included in The Moline-Rock Island Mfg. Co. (110) and Kansas City Pwr. & Lt. Co. (50).

Virginian Power Company—Appalachian Electric Pwr. Co.(19).

Yadkin River Power Company—Carolina Power & Light Co. (43).

York Haven Water & Power Co.—Pennsylvania-New Jersey System (21).

(*a*) Actual over thirty-minute period.
(*b*) Actual over one-hour period.
(*c*) Estimated over one-hour period.
(*d*) Includes 12,500 kw. joint Edison Company.
(*e*) Includes 13,920 kw. joint Edison Company.
(*f*) Includes 24,239,872 kw.-h wealth Edison Company.
(*g*) Includes 2,767 kw. joint Edison Company.
(*h*) Estimated over fifteen-min
(*i*) Estimated.
(*k*) Kva.
(*l*) System fifteen-minute peri
(*m*) Over fifteen-minute period
(*n*) Over thirty-minute period.
(*o*) Over one-hour period.
(*p*) Estimated over ten-minute
(*q*) (*r*) Over eight-hour period
(*s*) Includes Keno plant, opera
(*t*) Includes 214,560 kw.-hr. n

Nov. 4	204,811,841	23,400	38,910		Dec. 5	156,732,805	(*i*) 34,010	36,310	36,310	Oct. 16	160,246,106	18,293	
Dec. 22	209,748,985	23,940	48,900	46,800	Dec. 3	183,091,200	21,809	45,100	42,000	Dec. 4	160,754,592	19,201	39,500
Dec. 21	275,502,706	31,440	72,000	68,000	Dec. 12	249,330,663	29,062	58,500	57,000	Dec. 10	196,615,340	22,444	46,500
Dec.	196,911,791	22,478	(*B*) 34,500	(*o*) 33,400		188,771,500	20,200	30,900	31,000	Dec. 19	152,702,800	17,411	22,700
Dec. 29	218,245,950	24,920	50,800	49,500	Dec. 9	152,125,000	17,250	35,600	34,500	Dec. 7	115,431,550	13,150	
Dec. 14	208,994,394	23,858	40,100	39,950	Dec. 30	165,364,793	18,761	36,100	35,700	Dec. 20	147,423,930	16,890	
Dec. 22	170,852,661	19,450	28,800		(*D*) Dec. 23	149,220,978	17,000						
Dec.	252,735,540	28,851	56,000	55,000	Dec. 12	226,584,380	26,000	51,700		Dec.	211,765,420	24,174	46,500
Dec. 8	217,377,479	24,400	48,700	43,100	Dec. 23	168,403,952	19,200	40,650	39,583	Dec. 5	143,749,060	16,409	35,300
Jan. 1	178,047,098	20,340	41,200		Dec. 17	148,402,996	17,143	58,826		May	152,681,540	17,400	
Aug. 6	197,864,432	22,620		39,800	Dec. 23	164,162,797	18,700						
Dec. 17	184,683,171	21,069	69,000	69,000	Nov. 5	245,047,430	27,883	43,500	43,500	Dec. 18	127,357,201	14,563	
Dec. 16	196,762,929	22,470	45,544	45,544	Dec. 18	181,810,339	20,754	39,478	39,478	May 8-11	169,453,319	19,350	38,326
Nov. 24	156,979,298	17,930	36,456	32,000	Nov. 15	129,946,323	18,100	30,850		Dec.	108,364,544		
Dec.	224,109,866	25,582	37,749		Dec. 10	193,987,141	22,144	35,202		Dec. 5	162,443,207	18,544	
Dec. 29	157,662,360	17,997	33,400	32,000	Dec. 19	147,218,203	16,757	29,600	29,600	Dec. 7	136,757,822	15,611	31,900
Dec.	177,590,200	20,272	35,200		Dec.	163,783,700	18,697	33,000		Dec. 3	160,464,200	18,300	29,600
May 1	190,355,000	21,750	54,700	52,000	Nov. 19	163,178,438	18,600	60,200	58,500	Oct. 23 / Nov. 22	181,202,880	20,685	56,000
Oct.	177,233,500	20,230	34,700		Dec. 18	166,110,700	18,961	34,000		Dec. 19	160,624,600	18,335	30,200
(*v*) Dec. 30	174,943,577	20,000		(*o*) 33,300		154,117,396	17,550	32,200		Dec. 3	146,136,310	16,700	32,500
Dec. 1	155,470,639	18,060	48,800	46,000	Dec. 22	121,512,151	14,095	47,782	45,500	Jan. 3	133,707,946	15,280	47,500
Aug.	155,585,707	17,760				137,304,890	15,680	25,000		Sept.	116,676,395	13,319	
Dec. 21	151,475,140	17,280											
Dec.	147,218,200	16,805											
Dec.	144,739,433	16,522	31,700		Dec. 22	127,924,350	14,603	16,300		Dec. 3	105,400,728	12,032	
Dec.	183,622,525	20,961	50,000		Dec. 31	257,757,000	29,413	45,067		Dec. 18	240,662,700	27,472	38,500
Dec. 21	138,876,293	15,853	(*o*) 41,440	45,000	Dec. 18	124,813,962	(*o*) 14,209	40,060	43,500	Dec. 10	126,621,397	14,430	38,030
Dec. 4	(*w*) 128,835,193	14,700	35,000	30,000	Dec.	113,239,516	12,900						
(*n*) Aug. 22	252,186,398	28,788		(*r*) 30,297	(*r*) Dec. 9	258,750,604	29,457	34,510		Oct. 19	261,577,017	29,860	32,449
Dec.	121,627,000	13,872	31,700	30,800	Dec. 22	112,743,000	14,000						
	128,571,450	14,693		28,500		140,899,810	16,000	24,336		June	114,597,745		
Dec. 21	(*A*) 104,207,062	(*A*) 11,900											
(*y*)	118,617,000	13,541	(*B*) 26,400		Dec. 10	107,440,900	12,250	24,600	24,600	Nov. 27	100,205,700	11,439	
Dec. 4	108,316,069	12,400											
Dec. 18	117,956,180	13,465											
Sept. 30	106,992,465	12,230											
Feb. 4	108,822,300	12,423											
Dec. 8	3,298,347,874	376,409	576,403	567,853	Dec. 22	3,026,615,156	344,560	520,084		Nov. 27	2,906,519,819	331,795	46,471
Nov. 24	2,421,046,311	276,000	347,448	347,448	Nov. 7	2,066,066,762	235,000	272,500	272,500	Nov. 7	1,667,397,876	190,342	250,000
Dec. 9	1,175,430,654	134,182	221,060	220,000	Dec. 24	1,157,648,660	150,000	197,565	197,565	Nov. 8	1,089,099,507	124,326	185,500
Dec. 22	336,907,650	38,460	75,200	70,900	Dec. 9	300,456,350	34,298	32,700	33,700	Dec. 29	129,548,600	14,789	
Dec. 31	261,996,380	29,270	46,065	46,065	Oct. 28	200,520,080	22,700	39,835	39,600	Nov. 20	164,609,860	18,800	38,048
Jan.	252,891,600	28,850											
Sept. 30	107,576,036	12,290											
	561,425,403	64,003											
Jan. 23	1,063,504,660	121,405		272,760	Jan. 26	1,019,620,637	116,073	254,850	261,950	Mar. 29	960,340,481	109,625	246,770
Feb. 27	630,560,494	69,436		(*o*) 185,866	Dec. 23	604,581,618	68,828	170,485		Dec. 13	576,457,379	60,205	
Dec. 23	508,481,425	58,046	(*o*) 132,200	138,000	Dec. 26	478,911,990	54,521	126,200	131,000	Jan. 17	449,827,260	51,314	118,800
Jan. 28	385,707,158	44,030		120,885	Jan. 21	371,519,687	42,295	115,154	115,154	Jan. 17	383,313,078	43,757	110,446
Jan. 2	266,137,403	30,380	96,300	(*o*) 75,400	Dec. 26	244,345,733	29,000	70,600	70,600	Feb. 15	244,113,039	26,551	72,000
Jan. 28	247,490,105	28,252	94,869	90,557	Jan. 21	261,091,060	29,723	82,965	86,000	Dec. 19	257,983,320	29,382	78,755
Dec. 10	209,542,400	14,914											
Dec. 28	184,775,459	21,100	62,500		Dec. 24	173,938,625	19,850	47,120		Jan. 25	163,895,940	18,709	48,470
Dec. 15	183,000,000	20,900	50,000	(*o*) 44,000	April 3	185,000,000	21,000	43,000	43,000	Dec. 21	198,211,000	22,627	
	144,413,357	16,500				143,000,000	16,280	51,218	59,000	Feb. 13	146,605,919	16,736	47,005
	136,993,694	15,500				(*i*) 116,974,186					122,643,791		
an. 27–Dec. 22	127,740,470	14,582	43,000	40,820	Dec. 18	129,383,860	14,730	42,600		Feb. 14	128,302,450	14,647	40,200

0 kw. joint operation with Commonwealth
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0 kw. joint operation with Commonwealth
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9,872 kw.-hr. joint operation with Common-
ompany.
kw. joint operation with Commonwealth
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fifteen-minute period.

minute period.
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period.
ten-minute period.
hour period.
plant, operated under lease.
0 kw.-hr. not billed to the company.

(*u*) Includes Ozark Power & Water Company.
(*v*) Maximum daily kw.-hr.
(*w*) At busbar.
(*x*) Over five-minute period, 25-cycle system 12,500 kw.; 60 cycle system 17,800 kw.
(*y*) 25-cycle system Dec. 2; 60-cycle system Dec. 9.
(*A*) Includes North Westchester Lighting Company and Peekskill Lighting & Railroad Company.
(*B*) Over five-minute period.
(*C*) Part of output included prior to 1926, now included in Columbia Power Company.
(*D*) Includes 11,000 kw. joint operation with Commonwealth Edison Company.
(*E*) Includes 50,961,607 kw.-hr. joint generation with Commonwealth Edison Company.
(*F*) Includes output of Vancouver Island Power Co. and Western Power Company of Canada.
(*G*) On generating plant only.
(*H*) Includes Ottawa River Power Company.

(*I*) Includes Buffalo Gas & Electric Corp., Niagara, Lockport & Ontario Power Co. and the Niagara Falls Power Co. (including Canadian Niagara Power Co., Ltd.), together with certain small distributing companies operating in that territory.
(*J*) Includes Manitoba Power Company, Ltd.
(*K*) Figures prior to 1926, for Northern Indiana Gas & Electric Company only.
(*L*) Generated peak, estimated over thirty minutes; system peak, including purchased power totaled 54,900 kw.
(*M*) Estimated over twenty-minute period.
(*N*) Includes New York Edison Co., United Electric Light & Power Co., New York & Queens Electric Light & Power Co. and the Westchester Lighting Co., and, in 1926, North Westchester Lighting Co., Peekskill Lighting & Railroad Co., Bronx Gas & Electric Co. and Yonkers Electric Light & Power Co.
(*O*) Also included under Edison-United & Allied Companies. Omitted from U. S. total to avoid duplication.

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,910		Dec. 5	156,732,805	(i) 34,010	36,310	36,310	Oct. 16	160,246,106	18,293						
,900	46,800	Dec. 3	183,091,200	21,809	45,100	42,000	Dec. 4	160,754,592	19,201	39,500	Dec. 13	136,850,900	32,500	Dec. 7	
,000	68,000	Dec. 12	249,330,663	29,062	58,500	57,000	Dec. 10	196,615,340	22,444	46,500	Dec. 8	159,836,687	37,500	Nov. 2	
,500	(o) 33,400		188,771,500	20,200	30,900	31,000	Dec. 19	152,702,800	17,411	22,700	Dec. 29	120,698,840	22,190	Dec. 1	
,800	49,500	Dec. 9	152,125,000	17,250	35,600	34,500	Dec. 7	115,431,550	13,150						
,100	39,950	Dec. 30	165,364,793	18,761	36,100	35,700	Dec. 20	147,423,930	16,890						
,800		(D) Dec. 23	149,220,978	17,000											
,000	55,000	Dec. 12	226,584,380	26,000	51,700		Dec.	211,765,420	24,174	46,500	Dec. 13	188,000,000			
,700	43,100	Dec. 23	168,403,952	19,200	40,650	39,583	Dec. 5	143,749,060	16,409	35,300	Nov. 15	120,011,093			
,200		Dec. 17	148,402,996	17,143	58,826		May	152,681,540	17,400						
	39,800	Dec. 23	164,162,797	18,700											
,000	69,000	Nov. 5	245,047,430	27,883	43,500	43,500	Dec. 18	127,357,201	14,563						
,544	45,544	Dec. 18	181,810,339	20,754	39,478	39,478	May 8-11	169,453,319	19,350	38,326	Dec. 14	138,356,280	29,350	Nov. 9	
,456	32,000	Nov. 15	129,946,323	18,100	30,850		Dec.	108,364,544							
,749		Dec. 10	193,987,141	22,144	35,202		Dec. 5	162,443,207	18,544						
,400	32,000	Dec. 19	147,218,203	16,757	29,600	29,600	Dec. 7	136,757,822	15,611	31,900	Dec. 5	112,546,832	28,400	Dec. 20	
,200		Dec.	163,783,700	18,697	33,000		Dec. 3	160,464,200	18,300	29,600	Dec. 7	139,167,200	25,000	Dec.	
,700	52,000	Nov. 19	163,178,438	18,600	60,200	58,500	{Oct. 23 / Nov. 22}	181,202,880	20,685	56,000	Dec. 14	134,000,000	31,700	Nov. 14	
,700		Dec. 18	166,110,700	18,961	34,000		Dec. 19	160,624,600	18,335	30,200	Dec. 6	140,272,500	28,200	Oct. 28	
	(o) 33,300		154,117,396	17,550	32,200		Dec. 3	146,136,310	16,700	32,500	Dec. 11	128,445,449			
,800	46,000	Dec. 22	121,512,151	14,095	47,782	45,500	Jan. 3	133,707,946	15,280	47,500	Dec. 18	115,938,294	40,300	Dec. 21	
			137,304,890	15,680	25,000		Sept.	116,676,395	13,319						
,700		Dec. 22	127,924,350	14,603	16,300		Dec. 3	105,400,728	12,032						
,000		Dec. 31	257,757,000	29,413	45,067		Dec. 18	240,662,700	27,472	38,500	Dec. 21	178,790,374	29,500	Oct. 15	
,440	45,000	Dec. 18	124,813,962	(o) 14,209	40,060	43,500	Dec. 10	126,621,397	14,430	38,030	Dec. 20	110,225,488			
,000	30,000	Dec.	113,239,516	12,900											
	(r) 30,297	(r) Dec. 9	258,750,604	29,457	34,510		Oct. 19	261,577,017	29,860	32,449	Nov. 3	246,175,203	35,018	Aug. 14	
,700	30,800	Dec. 22	112,743,000	14,000											
	28,500		140,899,810	16,000	24,336		June	114,597,745							
,400		Dec. 10	107,440,900	12,250	24,600	24,600	Nov. 27	100,205,700	11,439						
,403	567,853	Dec. 22	3,026,615,156	344,560	520,084		Nov. 27	2,906,519,819	331,795	46,471	Dec. 13	2,392,092,267			
,448	347,448	Nov. 7	2,066,066,762	235,000	272,500	272,500	Nov. 7	1,667,397,876	190,342	250,000	Dec. 19	1,383,390,773	160,500	Dec. 19	
,060	220,000	Dec. 24	1,157,646,660	150,000	197,565	197,565	Nov. 8	1,089,099,507	124,326	185,500	Nov. 27	945,206,656	165,900	Nov. 16	
,200	70,900	Dec. 9	300,456,350	34,298	32,700	33,700	Dec. 29	129,548,600	14,789				27,200	March	
,065	46,065	Oct. 28	200,520,080	22,700	39,835	39,600	Nov. 20	164,609,860	18,800	38,048	Dec. 11	144,509,000	34,264	Nov. 23	
	272,760	Jan. 26	1,019,620,637	116,073	254,850	261,950	Mar. 29	960,340,481	109,625	246,770	Jan. 24	886,223,920	242,760	Dec. 30	
	(o) 185,866	Dec. 23	604,581,618	68,828	170,485		Dec. 13	576,457,379	60,205			735,246,576			
,200	138,000	Dec. 26	478,911,990	54,521	126,200	131,000	Jan. 17	449,827,260	51,314	118,800	Jan. 24	413,992,125	116,000	Dec. 22	
	120,885	Jan. 21	371,519,687	42,295	115,154	115,154	Jan. 17	383,313,078	43,757	110,446	Dec. 19	346,506,580	105,303	Dec. 22	
,300	(o) 75,400	Dec. 26	244,345,733	29,000	70,600	70,600	Feb. 15	244,113,039	26,551	72,000	Dec. 30	214,906,725	64,000	Dec. 30	
,869	90,557	Jan. 21	261,091,060	29,723	82,965	86,000	Dec. 19	257,983,320	29,382	78,755	Dec. 13	240,547,615	25,905	Jan. 18	
,500		Dec. 24	173,938,625	19,850	47,120		Jan. 25	163,895,940	18,709	48,470	Jan. 3	157,450,819	50,750	Dec. 23	
,000	(o) 44,000	April 3	185,000,000	21,000	43,000	43,000	Dec. 21	198,211,000	22,627						
			143,000,000	16,280	51,218	59,000	Feb. 13	146,605,919	16,736	47,005	Dec. 14	145,675,337	44,599	Feb. 8	
			(i) 116,974,186					122,643,791							
,000	40,820	Dec. 18	129,383,860	14,730	42,600		Feb. 14	128,302,450	14,647	40,200	Dec. 12	123,830,190	43,500	Jan. 13	

Includes Ozark Power & Water Company.
Maximum daily kw.-hr.
At busbar.
Over five-minute period, 25-cycle system 12,500 kw.; 60 cle system 17,800 kw.
25-cycle system Dec. 2; 60-cycle system Dec. 9.
Includes North Westchester Lighting Company and Peeksll Lighting & Railroad Company.
Over five-minute period.
Part of output included prior to 1926, now included in olumbia Power Company.
Includes 11,000 kw. joint operation with Commonwealth dison Company.
Includes 50,961,607 kw.-hr. joint generation with Commonealth Edison Company.
Includes output of Vancouver Island Power Co. and estern Power Company of Canada.
On generating plant only.
Includes Ottawa River Power Company.

(I) Includes Buffalo Gas & Electric Corp., Niagara, Lockport & Ontario Power Co. and the Niagara Falls Power Co. (including Canadian Niagara Power Co., Ltd.), together with certain small distributing companies operating in that territory.
(J) Includes Manitoba Power Company, Ltd.
(K) Figures prior to 1926, for Northern Indiana Gas & Electric Company only.
(L) Generated peak, estimated over thirty minutes; system peak, including purchased power totaled 54,900 kw.
(M) Estimated over twenty-minute period.
(N) Includes New York Edison Co., United Electric Light & Power Co., New York & Queens Electric Light & Power Co. and the Westchester Lighting Co., and, in 1926, North Westchester Lighting Co., Peekskill Lighting & Railroad Co., Bronx Gas & Electric Co. and Yonkers Electric Light & Power Co.
(O) Also included under Edison-United & Allied Companies. Omitted from U. S. total to avoid duplication.

(P) Includes Union Electric Light & Power Company (Mi Union Electric Light & Power Company of Illinois, E Louis & Suburban Company and Mississippi River Pow and in 1926, Central Mississippi Valley Elec. Prop Louis, Mo.)
(Q) Includes Milwaukee Electric Railway & Light Co Wisconsin Gas & Electric Company, Wisconsin T Light & Power Company, Peninsular Power Compan waukee Northern Railway Company and Wisconsin Power Company, and, prior to 1926, Wells Power Co and Badger Public Service Company.
(R) Includes Ontario Power Company and Toronto Po
(S) Includes Nevada-California Power Co. and Yuma Co.; prior to 1926, included Nevada-California Power Desert Water, Oil & Irrigation Co.
(T) Includes Great Western Power Co. of Cal., San Light & Power Corp. and Midland Counties Public Corp.

											66
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Dec. 7	112,472,748										69
											70
Nov. 28	134,588,457	31,500	May 25 & Sept. 28	129,618,270							71
Dec. 12	113,913,335	20,600	Dec. 10	112,736,089							72
											73
											74
											75
											76
											77
					32,030	Oct.	130,114,100	25,400	Sept. 5	114,446,685	78
											79
											80
Nov. 9	108,829,278	27,240	Sept. 15	114,416,090							81
											82
											83
Dec. 20	95,697,600	22,700	Nov. 10	120,598,174							84
Dec.	130,479,900										85
Nov. 14	97,754,000	32,500	Jan. 9	103,000,000							86
Oct. 28	127,758,800	25,500	Nov. 26	114,200,500							87
											88
											89
											90
Dec. 21	89,857,700	33,700	June 17	107,599,392							91
											92
											93
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											95
											96
Oct. 15	163,286,500										97
											98
											99
											100
Aug. 14	258,249,673	35,408	Nov. 12	257,752,195	35,794	April 23	264,272,468	33,519	Dec. 24	233,381,654	101
											102
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Dec. 19	863,124,240	192,200	Nov. 17	1,140,759,076	172,900	Jan. 14	1,031,111,695	136,800	Sept. 24	1,058,136,117	126
Nov. 16	907,237,573	169,450	Nov. 17	900,328,737	164,415	Dec. 16	852,680,550	166,730	Dec. 6	976,462,529	127
											128
March 1	122,684,800										129
Nov. 23	125,124,855										130
											131
											132
											133
											134
											....
											135
Dec. 30	846,487,668	242,020	Jan. 31	816,603,610	239,940	Dec. 19	810,158,475	204,000	Dec. 30	731,058,965	136
	712,683,840										137
Dec. 22	383,009,325	111,147	Jan. 15	389,784,451	110,000	Dec. 16	406,130,443	109,892	Feb. 21	385,346,075	138
Dec. 22	333,222,786	102,210	Jan. 14	349,027,334	101,120	Dec. 18	349,542,666	94,730	Dec. 27	339,232,739	139
Dec. 30	201,922,210	55,200	Jan. 5	199,737,907	53,900	Dec. 19	181,017,940	48,600	Jan. 3	165,377,180	140
Jan. 18	223,061,330	72,295	Jan. 14	246,212,170	71,760	Mar. 23	240,429,915	67,965	Mar. 23	228,131,265	141
											142
Dec. 23	149,275,239	46,440	Dec. 27	157,132,366	44,100	Dec. 29	140,435,406	38,360	Jan. 22	127,412,457	143
											144
Feb. 8	145,517,164	42,700	Dec. 21	139,711,248	42,612	Nov. 28	133,676,028	44,966	Feb. 19	131,351,288	145
											146
Jan. 13	129,804,772	51,740	Jan. 8	189,172,898	49,430	Oct. 27	211,707,571	57,280	Jan. 11	209,378,747	147
											148
											149
											150
											....

ompany (Missouri), of Illinois, East St. pi River Power Co., Elec. Props. (St.

& Light Company, Visconsin Traction, ver Company, Mil- Wisconsin Electric s Power Company

Toronto Power Co. and Yuma Utilities rnia Power Co. and

Cal., San Joaquin ties Public Service

(*U*) Also included under North American Co. (Cal. Properties System). Omitted from U. S. total to avoid duplication.

(*V*) Includes Metropolitan Edison System, Metropolitan Power Co., York Haven Water & Power Co., Penn Edison Co. and New Jersey Power & Light Co.

(*W*) Includes Broad River Power Co. and South Carolina Gas & Electric Co.

(*X*) Includes Holtwood Power Company.

(*Y*) Includes Madison Light & Power Company.

(*Z*) Figures prior to 1926, for Penn Public Service System.

(*aa*) For Texas Division.

(*bb*) Average load 9,111 kw. for five plants, four months and 14,004 kw. for six plants, eight months.

(*cc*) Output measured on d.c. side, average load on a.c. side.

(*dd*) Average of monthly maximum demands.

(*ee*) Not comparable with previous years because of merger.

(*ff*) Actual over twenty-minute period.

(*gg*) Based on total generation including energy used by Railway.

(*hh*) Plant peak 43,500 kw., Nov. 9th.

(*ii*) Includes purchased energy, also 591,893,200 kw.-hr. generated by Canadian Niagara Power Co., Ltd., See also notes *O* and *U*.

(*jj*) Includes purchased energy. Add also 591,893,200 kw.-hr. generated by Canadian Niagara Power Co., Ltd., included in U. S. total.

(*kk*) Energy consumed.

(*ll*) Includes Wisconsin River Power Co., Southern Wisconsin Power Co. and Central Wisconsin Power Co.

†Data received too late for inclusion in the table. Add to total given.

†Salem Electric Lighting Company, output 100,874,562 kw.-hr., instantaneous peak 26,600 kw., Dec. 28, average load 11,515 kw. and Cumberland County Power & Light Company, output 107,971,500 kw.-hr., thirty minute peak 29,740 kw., average load 12,325 kw.

Table II—Detailed Da
All

Line No.	Section and System	Generator Rating, Jan. 1, 1927				Genera
		Fuel Burnin Plants		Hydro Plants		Total Outp Kw.-Hr
		No. of Plants	Rating of Generat rs, Kva	No. of Plants	Rating of Generators, Kva.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	New England States					
1	New England Power System	1	17, 00	9	143,860	716,087
2	Edison Electric Illuminating Company of Boston	3	292, 17	0	0	673,760
3	Narragansett Electric Lighting Company	1	205, 00	0	0	367,579
4	Turners Falls Power & Electric Company	1	37, 00	3	67,500	321,816
5	Connecticut Light & Power Company	3	110, 00	2	30,600	286,218
6	Hartford Electric Light Company	2	76, 00	1	2,000	192,253
7	Central Maine Power Company	2	16, 75	22	72,705	183,268
8	New Bedford Gas & Edison Light Company	1	115, 00	0	0	172,222
9	Blackstone Valley Gas & Electric Company	2	(a) 36, 50	3	(a) 1,750	153,976
10	United Illuminating Company, Bridgeport, Conn	1	54, 00	0	0	115,535
11	United Electric Light Company, Springfield, Mass	1	55, 00	2	3,740	109,818
12	Worcester Electric Light Company	1	70, 25	0	0	105,039
	Totals for section*	19	1,094, 17	42	323,005	3,397,576
	Middle Atlantic States					
13	Buffalo, Niagara & Eastern Power Corp (*I*)	2	202, 00	5	636,900	4,463,911
14	Edison-United and Allied Companies (*K*)	13	(a) 913, 95	0	0	2,554,025
15	Philadelphia Electric Company System	6	640, 12	0	0	1,749,016
16	Public Service Electric & Gas Company (New Jersey)	10	609, 00	0	0	1,560,801
17	The West Penn Electric Company	18	533, 81	9	69,569	1,514,609
18	Duquesne Light Company	5	373, 10	0	0	1,332,033
19	Mohawk Hudson Power Corporation System	5	180, 00	23	711,600	1,157,858
20	Pennsylvania-New Jersey Power System (*S*)	6	222, 31	12	21,960	937,689
21	Brooklyn Edison Company, Inc	3	478, 00	0	0	874,023
22	Pennsylvania Power & Light Company	8	(a) 178, 00	3	(a) 40,450	858,001
23	Pennsylvania Water & Power Company (*aa*)	1	25, 00	1	119,750	531,681
24	Northern New York Utilities, Inc	2	7, 00	18	124,600	398,348
25	Penn Public System	10	112, 00	2	48,000	395,333
26	Rochester Gas & Electric Corporation	4	(a) 71, 75	6	(a) 30,855	326,148
27	New York & Queens Electric Light & Power Company (*dd*)	1	5, 00	0	0	255,121
28	Penn Central Light & Power Company	3	91, 50	2	5,050	227,630
29	Scranton Electric Company	3	72, 00	0	0	214,065
30	East Penn Electric Company	3	(a) 40, 50	0	0	176,135
31	Westchester Lighting Company (*dd*)	2	(a) 9, 70	0	0	126,197
32	Edison Electric Company (Lancaster)	0	0	0	0	125,911
33	Atlantic City Electric Company	1	32, 12	0	0	106,141
34	Staten Island Edison Corporation	1	44, 75	0	0	100,957
	Totals for section	92	5,040, 71	81	1,821,329	19,704,324
	South Atlantic States					
35	Southern Power Company	6	217, 50	25	552,985	1,433,759
36	Appalachian Electric Power Company	9	225, 00	5	33,066	975,664
37	Consolidated Gas Electric Light & Power Co. of Baltimore	3	(a) 225, 00	1	(a) 600	802,768
38	Carolina Power & Light Company	7	(a) 52, 10	12	(a) 36,300	426,399
39	Virginia Electric & Power Company	8	101, 40	9	29,010	377,662
40	Potomac Electric Power Company	1	120, 22	0	0	350,024
41	South Carolina System (*mm*)	2	60, 00	8	53,317 5	261,690
42	Columbus Electric & Power Company	7	(a) 12, 40	10	(a) 63,148	257,540
43	Florida Power & Light Company	35	(a) 138, 57	0	0	173,623
44	Tampa Electric Company	4	(a) 37, 75	1	(a) 600	100,462
	Totals for section	82	1,271, 32	71	786,278	5,159,595
	East North Central States					
45	Commonwealth Edison Company	8	(a) 933,500	0	0	3,482,632
46	Detroit Edison Company	4	(a) 583,000	6	(a) 8,850	2,025,063
47	Cleveland Electric Illuminating Company	4	449,050	0	0	1,118,294
48	Ohio Power Company	15	233,020	4	2,850	1,109,315
49	North American Company (Wisconsin System) (*MM*)	12	(a) 278,830	9	(a) 16,653	959,430
50	Consumers Power Company	12	(a) 130,050	30	(a) 107,140	809,134
51	Public Service Company of Northern Illinois	15	(a) 196,275	3	(a) 4,100	720,018
52	Union Gas & Electric Company	2	130,000	0	0	574,767
53	Pennsylvania-Ohio Power & Light Company	4	170,375	1	1,250	543,152
54	Ohio Public Service Company	7	157,875	1	900	535,078
55	Columbia Power Company	1	90,000	0	0	372,352
56	Northern Ohio Power & Light Company	1	(a) 67,000	1	(a) 2,200	356,040
57	Toledo Edison Company	4	(a) 125,180	2	(a) 6,950	350,695
58	Central Indiana Power Company System	14	138,600	1	480	334,518
59	Indiana & Michigan Electric Company	2	104,000	2	22,879	318,395
60	Central Illinois Public Service Company	20	92,380	0	0	278,626
61	Wisconsin Power & Light Company (*JJ*)	10	(a) 17,087	31	(a) 45,586	258,765
62	Interstate Public Service Company	2	38,775	5	4,660	243,812
63	Dayton Power & Light Company	5	126,969	0	0	238,006
64	Northern Indiana Public Service Company	5	(a) 43,275	4	(a) 490	227,490
65	Indianapolis Light & Heat Company	2	100,000	0	0	208,067
66	Illinois Electric Power Company	1	(a) 46,400	0	0	165,088
67	Cleveland Municipal Electric Light System	1	62,500	0	0	164,932
68	Wisconsin Public Service Corporation	4	(a) 40,950	9	(a) 29,118	150,635
69	Michigan Northern Power Company	0	0	1	45,600	150,060
70	Merchants Heat & Light Company	3	30,000	0	0	128,322
71	Moline-Rock Island Manufacturing Company	2	71,500	2	5,100	124,713
72	Indiana Service Corporation	1	(a) 31,000	0	0	123,632
73	Central Illinois Light Company	2	(a) 33,600	0	0	117,679
74	Indiana General Service Company	3	39,200	0	0	104,648
	Totals for section	166	5,004,244	112	343,719	16,293,370

Data on Generator Rating, Output, Load Factor, Cus

All Companies Having an Output Over 100,000,000 K

Generated and Purchased Output, 1926			Distribution of Energy in Kilowatt-Hours, 1926							
Total Output, Kw.-Hr.	Generated, Kw.-Hr.	Purchased Kw.-Hr.	Residential	Commercial Lighting	Power	Light and Power	Electric Railways	Other Public Utilities	Intra-Company Business	L Lo
(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(
716,087,950	419,221,803	296,866,147	0	0	287,382,558	287,382,558	44,385,377	286,678,853	(k)	(h) 9
673,760,354	661,111,269	12,649,085	82,223,185	(f)	(b) 390,679,293	472,902,478	5,611,597	64,973,821	2,626,294	(I) 12
367,579,000	356,876,000	10,703,000	37,476,000	17,479,000	112,637,000	167,592,000	0	0	1,004,000	2
321,816,370	276,580,620	45,235,750	0	0	98,742,325	98,742,325	33,242,350	151,283,140	11,161,285	2
286,218,156	282,945,020	3,273,136	21,948,792	22,008,626	136,927,004	180,884,422	16,836,736	39,295,374	1,243,279	4
192,253,000	177,768,000	14,485,000	18,016,000	25,538,000	62,328,000	105,882,000	7,123,000	55,516,000	(k)	(D) 2
183,268,485	178,519,925	4,748,560	(b) 24,974,846	(c)	(F) 89,740,962	114,715,808	15,936,797	7,579,403	6,599,049	3
172,222,651	172,222,651	0	(b) 13,305,168	(c)	139,696,383	153,001,551	1,043,984	18,078,416	3,364,238	1
153,976,958	40,325,074	113,651,884	8,925,951	10,910,519	102,805,047	122,641,517	0	13,526,442	463,004	1
115,535,700	115,535,700	0	13,899,527	13,110,995	73,000,000	100,010,522	0	0	.....	1
109,818,700	80,365,700	29,453,000	12,352,866	19,324,187	46,010,879	77,687,932	2,085,321	17,089,000	.....	1
105,039,000	94,249,700	10,789,300	13,645,498	(G) 22,798,654	50,845,746	87,289,898	0	154,138	4,685,144	1
3,397,576,324	2,855,721,462	541,854,862	.....	.....	.....	.....	.....	.....	.....	.....
4,463,911,125	3,580,112,691	883,798,434	127,403,317	307,313,451	2,811,483,369	3,246,200,137	203,789,906	640,056,060	.....	(J) 37
2,554,025,704	2,552,839,024	1,186,680	(d) 1,822,911,865	(c)	(c)	1,822,911,865	234,689,673	6,607,950	25,141,531	(L) 46
1,749,016,316	1,748,950,350	65,966	132,397,085	253,644,440	632,473,178	1,018,514,703	(g) 396,355,338	136,077,973	7,975,434	19
1,560,801,782	1,440,536,452	120,265,330	(M) 399,656,287	(c)	644,882,005	1,044,538,292	242,327,783	15,776,720	8,942,713	24
1,514,609,984	1,489,161,227	25,448,757	(b) 154,489,211	(c)	966,152,189	1,150,641,400	85,113,746	62 246,155	(Q) 216,608,683	(
1,332,033,978	1,304,667,740	27,366,238	121,855,729	(P) 128,440,626	672,471,020	922,797,375	226,138,151	1,153,618	67,079,413	11
1,157,858,730	612,935,399	544,923,331	79,261,139	(v) 79,900,717	517,218,252	676,380,108	97,611,499	179,215,829	(U) 20,560,501	(V) 18
937,689,159	540,801,082	396,888,077	23,081,119	29,625,956	(T) 659,444,734	712,151,809	35,865,536	67,990,808	31,064,109	9
874,023,045	873,976,045	47,000	176,783,972	279,414,870	214,138,603	670,337,445	3,732,100	672,100	(W) 49,707,852	14
858,001,300	634,674,800	223,326,500	40,531,764	(Y) 62,420,612	583,017,666	685,970,042	56,314,438	35,583,165	.....	8
531,681,400	631,681,400	0	0	0	0	0	0	568,103,260	.....	(bb) 6
398,348,320	387,965,020	10,383,300	12,332,994	2,719,205	220,151,438	235,203,637	0	131,921,912	142,305,212	3
395,333,291	388,378,902	6,954,389	(b) 52,291,791	(c)	252,595,958	304,887,749	16,062,547	7,143,610	.....	6
326,148,706	265,012,471	61,136,235	(cc) 46,434,941	(c)	159,809,669	206,244,610	42,200,678	8,204,495	14,735,282	5
255,121,687	2,448,810	252,672,877	58,035,135	(ee) 50,631,197	100,476,933	209,143,265	3,259,840	0	3,033,930	3
227,630,419	224,851,700	2,778,719	15,095,775	12,241,926	135,365,360	162,703,061	5,289,750	23,665,492	3,577,738	3
214,065,156	211,384,019	2,681,137	.....	.....	.....	.....	.....	.....	.....	.....
176,135,500	160,995,800	15,139,700	4,585,489	(hh) 6,637,527	62,605,190	73,828,206	0	7,187,000	.....	2
126,197,021	148,500	126,048,521	(b) 43,438,168	(c)	29,641,337	73,079,505	2,064,500	(jj) 23,905,306	1,005,147	2
125,911,263	0	125,911,263	9,303,508	13,660,543	63,165,382	86,129,433	19,396,065	3,638,020	299,988	1
106,141,300	106,093,400	47,900	.....	.....	.....	.....	.....	.....	.....	.....
100,957,540	100,195,140	762,400	10,709,845	4,189,788	27,862,887	42,762,520	8,294,118	1,696,800	416,815	1
19,704,324,018	17,255,212,662	2,449,111,356	.....	.....	.....	.....	.....	.....	.....	.....
1,433,759,975	1,342,481,975	91,278,000	.....	.....	.....	.....	.....	.....	.....	.....
975,664,102	924,147,084	51,517,018	.....	.....	.....	.....	.....	.....	.....	.....
802,768,634	404,496,853	398,271,781	66,560,168	(s) 92,513,191	421,095,219	580,168,578	147,307,168	.....	5,251,626	7
426,399,670	317,805,196	108,594,474	15,423,274	(kk) 36,025,734	226,844,718	278,293,726	0	68,992,926	.....	7
377,662,174	374,409,174	3,253,000	(rr) 283,126,391	(c)	(c)	.....	(c)	(c)	45,567,773	4
350,024,224	350,018,992	5,232	(b) 124,225,515	(c)	69,473,556	193,699,071	95,869,595	2,847,139	8,655,106	4
261,690,006	198,722,492	62,967,514	(b) 14,481,515	(c)	(nn) 195,842,567	210,324,082	1,833,640	4,492,580	9,243,388	3
257,540,000	253,699,000	3,841,000	2,462,000	5,462,000	131,172,000	139,096,000	0	92,355,000	1,529,000	2
173,623,725	173,623,725	0	42,456,068	(oo) 54,047,004	42,804,451	139,307,523	374,976	654,700	.....	3
100,462,550	98,989,530	1,473,020	9,097,400	14,933,700	47,123,800	71,154,900	0	1,450,590	11,033,650	1
5,159,595,060	4,438,394,021	721,201,039	.....	.....	.....	.....	.....	.....	.....	.....
3,482,632,000	3,356,027,000	126,605,000	360,664,000	354,760,000	(ss) 1,316,033,000	2,022,457,000	892,407,000	222,587,000	12,252,000	33
2,025,063,700	2,023,242,500	1,821,200	207,081,514	234,123,192	1,023,196,304	1,464,401,010	170,160,300	75,095,018	17,418,500	(I) 29
1,118,294,193	1,117,378,899	915,294	119,539,668	(uu) 82,693,257	515,683,767	717,916,692	129,405,797	108,203,915	88,182,101	7
1,109,315,094	440,221,313	669,093,781	.....	.....	.....	.....	.....	.....	.....	.....
959,430,412	877,462,886	81,967,526	.....	.....	.....	.....	.....	.....	.....	.....
809,134,896	719,659,262	89,475,634	73,760,086	72,075,371	428,063,939	573,899,396	62,807,751	5,959,838	4,970,703	16
									(vv) 6,047,316	11
720,018,554	623,659,795	96,358,759	70,520,155	43,777,408	287,219,914	401,517,477	85,073,803	110,001,189		
574,767,060	302,979,220	271,787,840	48,517,633	(v) 61,716,455	261,887,416	372,121,504	58,408,784	41,075,364	6,954,412	9
543,152,601	539,782,400	3,370,201	32,882,798	(ww) 35,117,866	306,932,357	374,933,021	(yy) 35,122,671	70,665,320	(k)	6
535,078,389	373,406,530	161,671,859	24,802,909	22,946,067	346,692,190	394,441,166	.....	81,804,479	6,800,562	5
372,352,500	372,352,500	0	0	0	0	0	0	372,352,500	0	
356,040,480	192,008,600	164,031,880	29,127,159	21,217,836	210,295,087	260,640,082	(zz) 44,802,058	4,813,122	1,468,921	4
350,695,351	282,269,699	68,425,652	28,325,661	37,148,334	165,891,154	231,365,149	.....	47,581,339	17,699,060	5
334,518,201	291,427,748	43,090,453	18,056,985	43,555,701	112,503,362	174,116,048	3,430,800	86,218,160	15,631,868	5
318,395,010	318,087,010	308,000	.....	.....	.....	.....	.....	.....	.....	.....
278,626,089	171,921,522	106,704,567	23,061,354	27,144,552	131,961,577	182,167,483	0	12,551,718	34,599,648	4
258,765,399	228,773,619	29,991,780	16,036,238	15,965,273	43,316,414	75,317,925	(N N) 6,522,956	167,115,155	4,357,481	(K K)
243,812,849	139,001,110	104,811,739	17,690,432	14,453,270	42,769,598	74,913,270	.....	31,105,064	38,097,004	3
238,006,738	211,516,503	26,490,235	23,239,284	(AA) 27,824,030	109,513,814	160,577,128	(t)	(j) 49,147,084	2,047,187	2
227,490,211	109,147,701	118,342,510	14,421,323	(EE) 20,944,653	127,527,513	162,893,489	25,457,848	4,177,858	2,484,886	3
208,067,601	208,067,601	0	24,644,222	50,549,870	(DD) 73,482,119	148,676,211	0	9,396,160	10,046,609	3
165,088,310	165,044,010	44,300	0	0	0	0	0	159,719,174	0	
164,932,820	164,932,820	0	(b) 34,394,546	(c)	77,641,137	112,035,683	0	(GG) 22,079,956	13,487,900	(u) 1
150,635,115	145,099,155	5,535,960	7,575,981	(LL) 11,415,893	89,288,052	108,279,926	2,016,810	5,235,076	6,002,267	2
150,060,345	148,754,997	1,305,348	.....	.....	.....	.....	.....	.....	.....	.....
128,322,613	30,228,460	98,094,153	7,709,632	(H H) 31,371,631	43,961,579	83,042,842	0	25,146,503	1,339,100	1
124,713,651	93,751,000	30,962,651	0	0	0	0	21,800,024	93,758,147	5,216,880	
123,632,339	108,023,541	15,608,798	5,867,504	9,964,684	56,250,733	72,082,921	3,730,393	9,912,605	588,804	3
117,679,234	11,795,711	105,883,523	10,287,192	10,718,860	76,109,825	97,115,877	261,330	8,248,540	132,013	1
104,648,573	102,002,573	2,646,000	.....	.....	.....	.....	.....	.....	.....	.....
16,293,370,328	13,868,025,685	2,425,344,643	.....	.....	.....	.....	.....	.....	.....	.....

Supplement to ELECTRICAL WORLD, April 30, 1927

rator Rating, Output, Load Factor, Customers and D
Having an Output Over 100,000,000 Kw.-Hr. During

Distribution of Energy in Kilowatt-Hours, 1926								Customers, Jan. 1, 19		
Residential (10)	Commercial Lighting (11)	Power (12)	Light and Power (13)	Electric Railways (14)	Other Public Utilities (15)	Intra-Company Business (16)	Line Losses (17)	Residential (18)	Commercial Lighting (19)	Power (20)
0	0	287,382,558	287,382,558	44,385,377	286,678,853	(k)	(k) 97,641,162	0	0	
82,223,185	(f)	(b) 390,679,293	472,902,478	5,611,597	64,973,821	2,626,294	(l) 127,646,164	(c)	(c)	(c)
37,476,000	17,479,000	112,637,000	167,592,000	0	0	1,004,000	26,766,000	85,100	533	2,81
0	0	98,742,325	98,742,325	33,242,350	151,283,140	11,161,285	27,387,270	0	0	
21,948,792	22,008,626	136,927,004	180,884,422	16,836,736	39,295,374	1,243,279	47,958,345	65,450	10,924	2,354
18,016,000	25,538,000	62,328,000	105,882,000	7,123,000	55,516,000	(k)	(D) 23,732,000	51,400	8,900	2,100
(b) 24,974,846	(c)	(F) 89,740,962	114,715,808	15,936,797	7,579,403	6,599,049	38,437,428	48,921	8,079	4,326
(b) 13,305,168	(c)	139,696,383	153,001,551	1,043,984	18,078,416	3,364,238	16,985,155	(b) 36,605	(c)	1,504
8,925,951	10,910,519	102,805,047	122,641,517	0	13,526,442	463,004	17,345,995	(u) 34,475	(u) 6,045	(u) 1,468
13,899,527	13,110,995	73,000,000	100,010,522	0	0		15,525,178	(m) 47,000	(c)	(c)
12,352,866	19,324,187	46,010,879	77,687,932	2,085,321	17,089,000		10,635,399	36,931	7,804	1,156
13,645,498	(G) 22,798,654	50,845,746	87,289,898	0	154,138	4,685,144	12,909,820	43,094	(H) 6,650	1,932
127,403,317	307,313,451	2,811,483,369	3,246,200,137	203,789,906	640,056,060		(J) 373,865,022	187,908	35,609	1,634
(d) 1,822,911,865	(c)	(c)	1,822,911,865	234,689,673	6,607,950	25,141,531	(L) 464,674,685	(n) 1,094,559	(c)	(c)
132,397,085	253,644,440	632,473,178	1,018,514,703	(g) 396,355,338	136,077,973	7,975,434	190,092,868	357,529	80,161	15,47
(M) 399,656,287	(c)	644,882,005	1,044,538,292	242,327,783	15,776,720	8,942,713	249,216,274	(O) 677,512	(c)	(N) 26,717
(b) 154,489,211	(c)	966,152,189	1,150,641,400	85,113,746	62 246,155	(Q) 216,608,683	(R)	(b) 200,009	(c)	7,709
121,855,729	(P) 128,440,626	672,471,020	922,797,375	226,138,151	1,153,618	67,079,413	114,865,421	214,487	(P) 32,297	1,519
79,261,139	(v) 79,900,717	517,218,252	676,380,108	97,611,499	179,215,829	(U) 20,560,501	(V) 184,090,793	(m) 259,065	(c)	(c)
23,081,119	29,625,956	(T) 659,444,734	712,151,809	35,865,536	67,990,808	31,064,109	90,616,897	(m) 107,437	(c)	(c)
176,783,972	279,414,870	214,138,603	670,337,445	3,732,100	672,100	(W) 49,707,852	149,573,548	(X) 585,626	(X) 86,544	(X) 12,280
40,531,764	(Y) 62,420,612	583,017,666	685,970,042	56,314,438	35,583,165		80,133,655	134,347	(Z) 24,932	4,329
0	0	0	0	0	568,103,260		(bb) 63,578,140	0	0	0
12,332,994	2,719,205	220,151,438	235,203,637	0	131,921,912	142,305,212	30,690,998	20,312	2,770	819
(b) 52,291,791	(c)	252,595,958	304,887,749	16,062,547	7,143,610		67,239,385	(d) 95,038	(c)	(c)
(cc) 46,434,941	(c)	159,809,669	206,244,610	42,200,678	8,204,495	14,735,282	54,763,641	(b) 83,716	(c)	6,437
58,035,135	(ee) 50,631,197	100,476,933	209,143,265	3,259,840	0	3,033,930	39,684,602	(ff) 203,064	(gg) 19,736	(ff) 3,895
15,095,775	12,241,926	135,365,360	162,703,061	5,289,750	23,665,492	3,577,738	32,394,378	36,618	5,165	1,571
								55,141	8,973	2,398
4,585,489	(hh) 6,637,527	62,605,190	73,828,206	0	7,187,000		27,074,204	2,855	(ii) 533	87
(b) 43,438,168	(c)	29,641,337	73,079,505	2,064,500	(jj) 23,905,306	1,005,147	26,142,563	(m) 86,588	(c)	(c)
9,303,508	13,660,543	63,165,382	86,129,433	19,396,065	3,638,020	299,988	16,447,757	29,660	5,077	2,637
								30,816	7,593	1,278
10,709,845	4,189,788	27,862,887	42,762,520	8,294,118	1,696,800	416,815	10,374,306	(m) 33,884	(c)	(c)
								61,875	12,029	3,488
66,560,168	(s) 92,513,191	421,095,219	580,168,578	147,307,168		5,251,626	70,041,262	150,886	(c) 23,263	273
15,423,274	(kk) 36,025,734	226,844,718	278,293,726	0	68,992,926		79,113,018	42,561	(ll) 13,552	2,418
(rr) 283,126,391	(c)	(c)		(c)	(c)	45,567,773	48,968,010	(m) 88,764	(c)	(c)
(b) 124,225,515	(c)	69,473,556	193,699,071	95,869,595	2,847,139	8,655,106	48,953,313	(d) 122,743	(c)	(c)
(b) 14,481,515	(c)	(nn) 195,842,567	210,324,082	1,833,640	4,492,580	9,243,388	35,796,316	(m) 22,115	(c)	(c)
2,462,000	5,462,000	131,172,000	139,096,000	0	92,355,000	1,529,000	24,560,000	9,774	(u) 3,000	(u) 100
42,456,068	(oo) 54,047,004	42,804,451	139,307,523	374,976	654,700		33,286,527	77,319	(pp) 17,799	4,821
9,097,400	14,933,700	47,123,800	71,154,900	0	1,450,590	11,033,650	16,823,410	28,360	(qq)	(qq)
[360,664,000	354,760,000	(ss) 1,316,033,000	2,022,457,000	892,407,000	222,587,000	12,252,000	332,929,000	729,370	114,557	(tt) 20,554
207,081,514	234,123,192	1,023,196,304	1,464,401,010	170,160,300	75,095,018	17,418,500	(l) 297,988,900	398,755	63,551	10,904
119,539,668	(uu) 82,693,257	515,683,767	717,916,692	129,405,797	108,203,915	88,182,101	74,585,688	237,653	(v) 32,497	1,933
								131,346	24,319	4,959
73,760,086	72,075,371	428,063,939	573,899,396	62,807,751	5,959,838	4,970,703	161,497,208	(m) 240,511	(c)	(c)
						(vv) 6,047,316	117,378,769	203,554	31,998	8,131
70,520,155	43,777,408	287,219,914	401,517,477	85,073,803	110,001,189			184,032	22,871	12,565
48,517,633	(v) 61,716,455	261,887,416	372,121,504	58,408,784	41,075,364	6,954,412	96,206,996	118,015	(v) 19,016	4,655
32,882,798	(ww) 35,117,866	306,932,357	374,933,021	(yy) 35,122,671	70,665,320	(k)	62,431,589	69,055	(xx) 10,219	1,755
24,802,909	22,946,067	346,692,190	394,441,166		81,804,479	6,800,562	52,032,182	60,148	9,498	1,888
0	0	0	0	0	372,352,500	0	0	0	0	0
29,127,159	21,217,836	210,295,087	260,640,082	(zz) 44,802,058	4,813,122	1,468,921	44,316,297	51,363	6,948	1,482
28,325,661	37,148,334	165,891,154	231,365,149		47,581,339	17,699,060	54,049,803	72,408	9,464	2,309
18,056,985	43,555,701	112,503,362	174,116,048	3,430,800	86,218,160	15,631,868	55,121,325	63,504	12,504	3,226
								36,253	3,848	1,155
23,061,354	27,144,552	131,961,577	182,167,483	0	12,551,718	34,599,648	47,895,865	101,747	21,203	11,385
16,036,238	15,965,273	43,316,414	75,317,925	(N N) 6,522,956	167,115,155	4,357,481	(K K) 5,451,882	52,616	8,894	2,706
17,690,432	14,453,270	42,769,598	74,913,270		31,105,064	38,097,004	37,025,356	65,567	10,284	3,952
23,239,284	(AA) 27,824,030	109,513,814	160,577,128	(t)	(j) 49,147,084	2,047,187	26,235,339	68,309	(BB) 8,668	2,448
14,421,323	(EE) 20,944,653	127,527,513	162,893,489	25,457,848	4,177,858	2,484,886	32,476,130	43,347	(FF) 7,737	1,461
24,644,222	50,549,870	(DD) 73,482,119	148,676,211	0	9,396,160	10,046,609	39,948,621	69,702	9,214	154
0	0	0	0	0	159,719,174	0	5,369,136	0	0	0
(b) 34,394,546	(c)	77,641,137	112,035,683	0	(GG) 22,079,956	13,487,900	(u) 17,329,281			
7,575,981	(LL) 11,415,893	89,288,052	108,279,926	2,016,810	5,235,076	6,002,267	29,101,036	27,052	5,380	1,540
7,709,632	(H H) 31,371,631	43,961,579	83,042,842	0	25,146,503	1,339,100	18,794,168	(II) 26,222	(c)	726
0	0	0	0	21,800,024	93,758,147	5,216,880	3,938,600	0	0	0
5,867,504	9,964,684	56,250,733	72,082,921	3,730,393	9,912.605	588,804	37,317,621	17,667	3,304	1,694
10,287,192	10,718,860	76,109,825	97,115,877	261,330	8,248,540	132,013	11,921,474	30,111	5,430	1,370
								28,655	2,392	1,016

58	Central Indiana Power Company System	14	138,000	1	480				

d Distribution of Energy of
ing 1926

Jan. 1, 1927			Consumption per Customer (Not Including Railways and Other Utilities), 1926	Load Factor, Per Cent		Line No.
Power	Electric Railways	Other Public Utilities		1926 (q)	1923 (q)	
(20)	(21)	(22)	(23)	(24)	(25)	(26)
.....	.....	.....	.....	44.2	(r) 47.1	1
(c)	(c)	(c)	.....	(n) 40.4	(n) 39.3	2
2,815	0	0	1,900	36.3	(n) 48.5	3
.....	.....	.....	.....	56.4	41.6	4
2,354	.....	.....	2,300	(r) 46.9	41.9	5
2,100	1	6	1,700	(E) 32.8	35.4	6
4,326	8	7	1,870	(r) 47.8	(n) 51.8	7
1,504	1	1	4,020	39.4	33.5	8
(u) 1,468	0	(u) 4	2,920	(r) 33.9	33.2	9
(c)	0	0	2,130	43.1	.....	10
1,156	.....	.....	1,695	(n) 34.9	.....	11
1,937	0	2	1,580	39.9	(z) 39.8	12
.....	.....	.....	.....	.....	.....	.....
1,634	23	26	14,400	74.7	.....	13
(c)	(c)	(c)	1,665	41.0	40.5	14
15,471	(g) 6	3	2,250	46.2	45.3	15
(N) 26,717	(N) 9	(N) 5	1,485	43.6	44.2	16
7,709	51	33	5,550	(r) 55.3	59.7	17
1,519	1	3	3,720	(n) 53.7	(n) 55.2	18
(c)	(c)	(c)	.....	52.5	(z) 54.0	19
(c)	(c)	(c)	.....	(r) 75.0	.....	20
(X) 12,280	(X) 3	(X) 1	980	38.3	39.3	21
4,329	38	28	4,200	(n) 50.3	(n) 59.2	22
0	0	6	.....	(r) 62.9	56.8	23
819	0	9	9,850	50.7	.....	24
(c)	.....	.....	3,210	50.2	43.3	25
6,437	1	6	2,140	(r) 53.9	50.5	26
(ff) 3,895	(ff) 1	0	922	41.2	40.4	27
1,571	108	15	3,760	41.6	47.1	28
2,398	1	.....	.....	(n) 34.1	(z) 52.8	29
87	0	1	21,250	(n) 60.3	.....	30
(c)	(c)	(c)	845	44.5	(z) 42.3	31
2,637	4	7	2,310	(r) 49.8	46.4	32
1,278	4	.....	.....	(n) 41.8	.....	33
(c)	(c)	(c)	.....	(r) 38.4	.....	34
.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	(r) 48.6	(r) 42.2	35
3,488	3	33	.....	(n) 48.9	.....	36
273	1	.....	3,320	(r) 56.4	(r) 55.9	37
2,418	0	10	4,750	(n) 51.2	.....	38
(c)	(c)	(c)	.....	52.4	48.3	39
(c)	.....	.....	1,580	44.4	45.2	40
(c)	(c)	(c)	.....	(r) 54.2	.....	41
(u) 100	0	12	10,800	43.2	49.8	42
4,821	10	2	1,395	(n) 30.9	.....	43
(qq)	0	3	1,930	41.5	.....	44
.....	.....	.....	.....	.....	.....	.....
(tt) 20,554	4	3	2,340	45.9	47.1	45
10,904	32	4	3,100	53.0	51.2	46
1,933	1	6	2,640	45.4	49.6	47
4,959	7	31	.....	(n) 51.1	(z) 56.0	48
(c)	(c)	(c)	.....	(n) 52.0	45.8	49
8,131	.....	.....	2,360	49.4	47.9	50
12,565	8	6	1,830	(B) 50.7	50.4	51
4,655	5	6	2,630	40.3	46.8	52
1,755	.....	3	4,680	46.9	63.7	53
1,888	.....	17	5,515	56.8	(n) 51.3	54
0	0	5	.....	43.7	.....	55
1,482	.....	.....	4,350	89.4	63.8	56
2,309	.....	20	2,745	52.0	42.8	57
3,226	1	.....	2,200	49.8	(z) 46.3	58
1,155	25	13	.....	(n) 39.7	43.0	59
11,385	0	32	1,255	42.7	47.1	60
2,706	.....	56	1,170	59.2	.....	61
3,952	.....	.....	940	(n) 48.1	.....	62
2,448	(i)	(j) 15	2,020	47.7	38.4	63
1,461	3	5	3,100	58.0	(z) 63.9	64
154	0	3	1,880	(n) 47.3	49.0	65
0	0	4	.....	44.9	.....	66
.....	.....	.....	.....	.....	56.2	67
1,540	1	9	3,200	(r) 51.7	(z) 50.7	68
.....	.....	.....	.....	(CC) 56.3	86.5	69
726	0	4	3,085	(n) 52.2	.....	70
0	3	3	.....	44.4	(z) 44.1	71
1,694	2	5	3,185	44.8	.....	72
1,370	.....	.....	2,635	48.8	(zp) 49.0	73
1,016	5	2	.....	(n) 50.4	.....	74
.....	.....	.....	.....	.....	.....	.....

(a) Kilowatts.
(b) Includes "commercial lighting"
(c) Included under "residential."
(d) Includes also commercial lighting and power.
(e) Includes street lighting.
(f) Included under "power."
(g) Includes railroads.
(h) Includes "intra-company business."
(i) Included under "electric railways."
(j) Includes electric railways.
(k) Included under "line losses."
(l) Transmission, conversion and distribution losses.
(m) Includes customers of all classes.
(n) Instantaneous peak.
(o) Peak load over 5-minute period.
(p) Peak load over 15-minute period.
(q) Peak load over 30-minute period.
(r) Peak load over one-hour period.
(s) Includes small power.
(t) Included under other public utilities.
(u) Estimated.
(v) Includes municipal lighting.
(w) Includes other public utilities.
(x) Includes electric railway and other public utilities.
(z) 1925 load factor.
(A) Horse power.
(B) Based on generating plant output only.
(C) Total number customer meters 312,966.
Bills to domestic customers, December, 219, 152.
Total bills, December, 283,091.
(D) Includes intra-company business, street lighting and unmetered business.
(E) On energy generated and purchased. Use factor of 40.5% on Hartford Electric Light load only.
(F) Includes heating and cooking.
(G) Includes 5,422,833 kw.hr. for street lighting. 1,386,160 kw.-hr. sold wholesale to other towns and 220,922 kw.-hr. miscellaneous.
(H) Includes 2 municipalities.
(I) Includes Buffalo Gas & Electric Corp., Niagara, Lockport & Ontario Power Co. and the Niagara Falls Power Co. (including Canadian Niagara Power Co., Ltd.) together with certain small distributing companies operating in that territory.
(J) Includes other losses.
(K) Includes New York Edison Co., United Electric Light & Power Co., New York & Queens Electric Light & Power Co., Westchester Lighting Co., Bronx Gas & Electric Co., Yonkers Electric Light & Power Co., North Westchester Lighting Co. and Peekskill Lighting & Railroad Co.
(L) All losses.
(M) Includes commercial lighting and 45,582,461 kw.-hr. for municipal street lighting.
(N) Meters.
(O) Meters includes commercial and municipal.
(P) Includes 38,991,203 kw.-hr. "other sales" to 2,901 customers.
(Q) Includes line losses.
(R) Included under intra-company business.
(S) Includes Metropolitan Edison System, Metropolitan Power Co., York Haven Water & Power Co., Penn Edison Co., and New Jersey Power & Light Co.
(T) Includes 380,557,938 kw.-hr. sold to affiliated companies.
(U) Includes 3,850,890 kw.-hr. sold to owned street railroads.
(V) Includes 73,779 kw.-hr. without direct charge.
(W) Includes auxiliaries and excitation.
(X) Approximate segregation of total number of meters.
(Y) Includes 21,547,169 kw.-hr. municipal sales.
(Z) Includes 838 municipal customers.
(aa) Includes Holtwood Power Company.
(bb) Includes all losses, station, local and transmission.
(cc) Includes commercial lighting and 13,508,794 kw.-hr. street lighting.
(dd) Also included under Edison United & Allied Companies. Omitted from total for Middle Atlantic States to avoid duplication.
(ee) Includes 11,680,531 kw.-hr. for street lighting.
(ff) Approximate.
(gg) Includes 1 street lighting customer.
(hh) Includes 2,105,395 kw.-hr. municipal sales.
(ii) Includes 24 municipal customers.
(jj) Includes 22,079,263 kw.-hr. transferred to affiliated companies.
(kk) Includes 20,770,714 kw.-hr. municipal sales.
(ll) Includes 269 municipal customers.
(mm) Includes Broad River Power Co. and South Carolina Gas & Electric Co.
(nn) Includes 49,442,716 kw.-hr. sales to affiliated utilities.
(oo) Includes 15,257,276 kw.-hr. municipal sales.
(pp) Includes 443 municipal customers.
(qq) Not available, total customers, all classes, including residential, 36,980.
(rr) Includes commercial lighting, power, electric railways and other utilities.
(ss) Includes 90,077,000 kw.-hr. retail power and 1,216,956,000 kw.-hr. wholesale light and power.
(tt) Includes 18,076 retail power customers and 2,478 wholesale light and power customers.
(uu) Includes 13,701,522 kw.-hr. municipal street lighting.
(vv) Includes 469,314 kw.-hr. supplied in Commonwealth Edison Company territory.
(ww) Includes 5,398,336 kw.-hr. municipal sales.
(xx) Includes 65 municipal customers.
(yy) Affiliated railways.
(zz) Deliveries to railway department of company.
(AA) Includes 4,151,331 kw.-hr. for street lighting.
(BB) Includes 82 street lighting customers.
(CC) Based on average for maximum eight-hour shift.
(DD) Includes 165,206 kw.-hr. miscellaneous.
(EE) Includes 7,146,921 kw.-hr. municipal sales.
(FF) Includes 128 municipal customers.
(GG) Includes 6,558,434 kw.-hr. municipal light and power and 15,521,522 kw.-hr. street lighting.
(HH) Includes 18,868,590 kw.-hr. municipal sales.
(II) Includes commercial and municipal customers.
(JJ) Includes Wisconsin River Power Co., Southern Wisconsin Power Co. and Central Wisconsin Power Co.
(KK) Includes distribution loss and company use.
(LL) Includes 2,828,094 kw.-hr. municipal sales.
(MM) Includes Milwaukee Electric Railway & Light Company, Wisconsin Gas & Electric Company, Wisconsin Traction, Light & Power Company, Peninsular Power Company, Milwaukee Northern Railway Company and Wisconsin Electric Power Company.
(NN) Transferred to electric railways.
(OO) Includes Union Electric Light & Power Company (Missouri), Union Electric Light & Power Company of Illinois, East St. Louis & Suburban Company, Mississippi River Power Company, and Central Mississippi Valley Electric Properties. (St. Louis, Mo.)

58	Central Indiana Power Company System	14		136,600	1		480	334,576,
59	Indiana & Michigan Electric Company	2		104,000	2		22,879	318,395,
60	Central Illinois Public Service Company	20		92,380	0		0	278,626,
61	Wisconsin Power & Light Company (*JJ*)	10	(*a*)	17,087	31	(*a*)	45,586	258,765,
62	Interstate Public Service Company	2		38,775	5		4,660	243,812,
63	Dayton Power & Light Company	5		126,969	0		0	238,006,
64	Northern Indiana Public Service Company	5	(*a*)	43,275	4	(*a*)	490	227,490,
65	Indianapolis Light & Heat Company	2		100,000	0		0	208,067,
66	Illinois Electric Power Company	1	(*a*)	46,400	0		0	165,088,
67	Cleveland Municipal Electric Light System	1		62,500	0		0	164,932,
68	Wisconsin Public Service Corporation	4	(*a*)	40,950	9	(*a*)	29,118	150,635,
69	Michigan Northern Power Company	0		0	1		45,600	150,060,
70	Merchants Heat & Light Company	3		30,000	0		0	128,322,
71	Moline-Rock Island Manufacturing Company	2		71,500	2		5,100	124,713,
72	Indiana Service Corporation	1	(*a*)	31,000	0		0	123,632,
73	Central Illinois Light Company	2	(*a*)	33,600	0		0	117,679,
74	Indiana General Service Company	3		39,200	0		0	104,648,
	Totals for section	166		5,004,244	112		343,719	16,293,370,
	West North Central States							
75	North American Company (Missouri, Illinois and Iowa) (*OO*)	4	(*a*)	281,250	1	(*a*)	135,000	1,337,733,
76	Northern States Power Company and subsidiaries	24	(*a*)	227,495	27	(*a*)	109,857	805,380,
77	Minnesota Power & Light Company	6	(*a*)	13,250	11	(*a*)	94,865	399,825,
78	Kansas City Power & Light Company	4		173,308	0		0	365,170,
79	Empire District Electric Company	5		67,710	2		3,800	214,669,
80	Kansas Gas & Electric Company	7	(*a*)	50,190	1	(*a*)	550	194,417,
81	Nebraska Power Company	1	(*a*)	73,000	0		0	187,052,
82	Des Moines Electric Light Company	(*Bb*) 3		73,800	0		0	128,293,
	Totals for section	54		1,074,818	42		403,800	3,632,542,
	East South Central States							
83	Southeastern Power & Light Company System	34	(*Cc*)	189,223	25		511,305	1,966,393,
84	Tennessee Electric Power Company	4	(*a*)	103,750	5	(*a*)	107,640	653,812,
85	U. S. War Department—Muscle Shoals	0		0	1		230,000	439,380,
86	New Orleans Public Service Inc.	2	(*a*)	91,700	0		0	222,927,
87	Louisville Gas & Electric Company and subsidiaries (*Ii*)	2	(*a*)	93,520	0		0	222,310,
88	Birmingham Electric Company	1	(*a*)	11,700	0		0	200,750,
89	Kentucky Utilities Company	27	(*a*)	58,500	0		0	146,560,
90	Memphis Power & Light Company	1	(*a*)	54,000	0		0	137,786,
91	Kentucky & West Virginia Power Company	1		16,000	0		0	137,256,
	Totals for section	72		691,323	31		867,805	4,127,177,
	West South Central States							
92	Texas Power & Light Company	38	(*a*)	71,005	4	(*a*)	230	339,468,
93	Houston Lighting & Power Company	6	(*a*)	73,231	0		0	263,299,
94	Oklahoma Gas & Electric Company	26	(*a*)	89,032	0		0	207,140,
95	Oil Belt Power Company	1	(*a*)	18,000	0		0	163,872,
96	Dallas Power & Light Company	1	(*a*)	32,500	0		0	159,430,
97	Fort Worth Power & Light Company	1	(*a*)	44,400	0		0	155,794,
98	Arkansas Power & Light Company	34	(*a*)	40,932	2	(*a*)	9,825	151,908,
99	Louisiana Power Company	1	(*a*)	25,000	0		0	123,937,
100	Gulf States Utilities Company	10	(*a*)	45,800	0		0	100,344,
	Totals for section	118		516,000	6		11,750	1,664,195,
	Mountain States							
101	Montana Power Company	0		0	8		227,000	1,379,194,
102	Utah Power & Light Company	4	(*a*)	37,040	35	(*a*)	158,847	801,444,
103	Public Service Company of Colorado	10		104,275	6		34,650	268,618,
104	Idaho Power Company	0		0	8	(*a*)	59,500	266,320,
105	Salt River Valley Water Users' Association	0		0	(*Xj*) 6		36,910	113,107,
106	Southern Colorado Power Company	4	(*a*)	23,596	1	(*a*)	1,200	102,206,
	Totals for section	18		175,575	64		556,560	2,930,891,
	Pacific States							
107	Southern California Edison Company	4	(*a*)	261,600	20	(*a*)	347,600	2,227,879,
108	Pacific Gas & Electric Company	4	(*a*)	142,000	28	(*a*)	400,475	2,157,886,
109	North American Company (California Properties System) (*Xm*)	8	(*a*)	82,000	14	(*a*)	246,074	1,334,964,
110	Great Western Power Company of Cal. (*Yh*)	4		30,000	2		131,669	770,836,
111	Puget Sound Power & Light Company	(*Xq*) 7	(*a*)	33,350	(*Xq*) 14	(*a*)	138,257	708,450,
112	San Joaquin Light & Power Corporation (*Yk*)	3		54,050	11		86,600	623,690,
113	Washington Water Power Company	0		0	7	(*a*)	139,750	571,833,
114	Los Angeles Bureau of Power and Light	0		0	5		95,757	521,136,
115	Portland Electric Power Company	3	(*a*)	56,500	6	(*a*)	79,230	476,272,
116	California Oregon Power Company	1	(*a*)	280	11	(*a*)	56,888	293,010,
117	Southern Sierras Power Company (*Xw*)	3	(*A*)	11,600	11	(*A*)	93,420	273,230,
118	Northwestern Electric Company	2	(*a*)	22,500	1	(*a*)	12,000	237,403,
119	Seattle Lighting Department	1		35,000	4		65,000	232,848,
120	Los Angeles Gas & Electric Corporation	2	(*a*)	108,700	0		0	213,459,
121	Tacoma Light Department	1		9,000	2	(*Yd*)	60,000	195,791,
122	Pacific Power & Light Company	16	(*a*)	12,700	10	(*a*)	21,625	166,214,
123	Western States Gas & Electric Company	2	(*a*)	8,500	3	(*a*)	26,470	128,836,
124	San Diego Consolidated Gas & Electric Company	2	(*a*)	46,000	0		0	123,369,
	Totals for section	56		964,200	115		2,027,957	9,862,588,
	Canada							
125	Hydro-Electric Power Commission of Ontario (*Yl*)	1		15,000	22		799,854	3,867,398,
126	Shawinigan Water & Power Company	0		0	(*Yn*) 14		406,080	2,557,613,
127	Montreal Light, Heat & Power Consolidated	1		16,500	4		220,500	1,251,502,
128	West Kootenay Power & Light Company, Ltd	0		0	3		84,525	410,327,
129	British Columbia Electric Railway Co., Ltd. (*Yp*)	1		12,500	3		113,325	333,654,
130	City of Winnipeg Hydro-Electric System	1		13,750	1		97,750	324,993,
131	Winnipeg Electric Company (*Ys*)	1		12,000	2		88,000	285,508,
132	Dominion Power & Transmission Company, Ltd.	1		20,000	1		38,500	241,355,
133	Ottawa & Hull Power Company (*Yx*)	0		0	3		53,600	177,990,
134	Kaministiquia Power Company, Ltd.	0		0	1		26,500	144,638,
	Mexico							
135	The Mexican Light & Power Company, Ltd.	5		15,350	13		136,025	594,046,
	Electric Railways							
136	Interborough Rapid Transit Company			390,000	0		0	1,063,717,
137	Chicago Surface Lines	0		0	0		0	(*Za*) 581,706,
138	Williamsburgh Power Plant Corporation (B.M.T.)	2		204,100	0		0	542,141,
139	Philadelphia Rapid Transit Company	4		57,275	0		0	390,915,
140	Pennsylvania Railroad Company (L. I.)	1	(*a*)	85,500	0		0	286,533,
141	Boston Elevated Railway Company	5		182,000	0		0	257,696,
142	New York, New Haven & Hartford Railroad Company	1		66,080	0		0	209,658,
143	New York Central Railroad Company	2		90,000	0		0	205,649,
144	Pacific Electric Railway Company	0		0	0		0	187,975,
145	Twin City Rapid Transit Company	1		75,000	2		16,000	140,216,
146	Chicago, Milwaukee & St. Paul Railway Company							(*Zc*) 138,083,
147	Kansas City Public Service Company	1		53,000	0		0	131,186,
148	The Connecticut Company	3		48,200	1		1,050	115,769,
149	Wilmington & Philadelphia Traction Company	1		26,400	0		0	111,341,
150	Norfolk & Western Railway Company	1		45,000	0		0	106,426,

23,061,354	27,144,552	131,961,577	182,167,483		12,551,719		36,253	3,848	1,155

318,395,010	318,087,010	308,000									
278,626,089	171,921,522	106,704,567	23,061,354	27,144,552	131,961,577	182,167,483	0	12,551,718	34,599,648		47,
258,765,399	228,773,619	29,991,780	16,036,238	15,965,273	43,316,414	75,317,925	(N N) 6,522,956	167,115,155	4,357,481	(K K)	5,
243,812,849	139,001,110	104,811,739	17,690,432	14,453,270	42,769,598	74,913,270		31,105,064	38,097,004		37,
238,006,738	211,516,503	26,490,235	23,239,284	(A A) 27,824,030	109,513,814	160,577,128	(t)	(j) 49,147,084	2,047,187		26,
227,490,211	109,147,701	118,342,510	14,421,323	(E E) 20,944,653	127,527,513	162,893,489	25,457,848	4,177,858	2,484,886		32,
208,067,601	208,067,601	0	24,644,222	50,549,870	(D D) 73,482,119	148,676,211	0	9,396,160	10,046,609		39,
165,088,310	165,044,010	44,300	0	0	0	0	0	159,719,174	0		5,
164,932,820	164,932,820	0	(b) 34,394,546	(c)	77,641,137	112,035,683	0	(G G) 22,079,956	13,487,900	(u)	17,
150,635,115	145,099,155	5,535,960	7,575,981	(L L) 11,415,893	89,288,052	108,279,926	2,016,810	5,235,076	6,002,267		29,
150,060,345	148,754,997	1,305,348									
128,322,613	30,228,460	98,094,153	7,709,632	(H H) 31,371,631	43,961,579	83,042,842	0	25,146,503	1,339,100		18,
124,713,651	93,751,000	30,962,651	0	0	0	0	21,800,024	93,758,147	5,216,880		3,
123,632,339	108,023,541	15,608,798	5,867,504	9,964,684	56,250,733	72,082,921	3,730,393	9,912,605	588,804		37,
117,679,234	11,795,711	105,883,523	10,287,192	10,718,860	76,109,825	97,115,877	261,330	8,248,540	132,013		11,
104,648,573	102,002,573	2,646,000									
,293,370,328	13,868,025,685	2,425,344,643									
,337,733,243	1,336,485,820	1,247,423									
805,380,692	756,103,768	49,276,924	89,712,204	(P P) 137,855,172	353,102,865	580,670,241	2,998,808	46,923,114	12,495,087		162,
399,825,337	398,351,136	1,474,201	14,577,881	(R R) 39,325,337	218,639,938	272,523,156	17,524,719	37,394,640			72,
365,170,871	364,925,864	245,007	44,775,633	(T T) 61,917,848	188,821,686	295,515,167	257,643	20,520,176			48,
214,669,321	183,142,206	31,527,115	4,724,971	6,742,512	150,297,588	161,765,071		15,170,158	1,215,044		36,
194,417,500	194,391,500	26,000	16,749,976	(X X) 24,948,754	101,654,797	143,353,527	8,222,288	9,882,900			32,
187,052,800	187,052,800	0	21,180,617	(Z Z) 34,592,368	88,551,181	144,324,166		25,554,281			17,
128,293,150	128,293,150	0	15,062,672	(V V) 14,776,041	55,556,276	85,394,989	(w) 12,150,058	(i)	12,368,535		18,
,632,542,914	3,548,746,244	83,796,670									
,966,393,998	1,452,770,522	513,623,476	(b) 158,165,817	(c)	(x) 1,346,112,573	(x) 1,504,278,390	(f)	(f)	(D d) 105,332,226		356,
653,812,207	640,517,207	13,295,000	19,056,891	23,390,850	345,010,041	387,457,782	5,557,340	119,321,627	42,143,540		99,
439,380,300	439,380,300	0	0	0	0	0	0	428,265,885	(N n) 11,114,115		
222,927,000	222,927,000	0	23,674,850	(E e) 35,100,345	93,178,911	151,954,106	20,758,687	0			50,
222,310,255	187,049,100	35,261,155	22,408,546	(J j) 44,746,367	90,465,221	157,620,134	0	39,010,060	3,287,087		22,
200,750,534	0	200,750,534	14,062,973	(G g) 25,313,244	127,432,449	166,808,666	0	0	997,344		32,
146,560,259	95,722,769	50,837,490	10,199,864	9,117,658	75,954,743	95,272,265	0	21,556,299	10,711,940		19,
137,786,000	137,770,000	16,000	12,001,571	(L l) 39,636,484	33,243,859	84,881,914	32,318,331	0			20,
137,256,705	40,947,830	96,308,875									
,127,177,258	3,217,084,728	910,092,530									
339,468,000	92,358,000	247,110,000	20,515,336	(O o) 33,192,706	149,474,844	203,182,886	22,102,074	48,442,219			65,
263,299,360	263,244,380	54,980	18,272,428	(Q q) 30,180,324	160,621,655	209,074,407	14,415,800	1,745,526			38,
207,140,920	191,684,078	15,456,842	20,257,738	(S s) 36,061,106	82,828,013	139,146,857	2,835,858	21,738,478	2,869,448		40,
163,872,000	163,872,000	0	0	0	0	0	0	150,466,920			13,
159,430,750	152,022,900	7,407,850	18,734,802	(U u) 27,428,143	56,966,605	103,129,550	42,831,202	1,103,285			12,
155,794,457	155,685,500	108,957	9,776,813	(W w) 15,350,327	70,294,491	95,421,631	0	41,192,800			21,
151,908,790	103,644,823	48,263,967	9,228,079	(Y y) 21,386,762	60,500,073	91,114,914	587,453	12,323,423	17,432,709		30,
123,937,000	122,937,000	0	0	0	0	0	0	122,937,000	0		
100,344,073	100,208,959	135,114	5,548,810	8,409,303	46,102,857	60,060,970	4,762,379	14,682,989	2,368,409		18,
,664,195,350	1,345,657,640	318,537,710									
,379,194,095	1,379,194,095	0	18,896,370	(X a) 21,853,787	972,805,061	1,013,555,218	(X b) 124,772,943	26,899,686	(k)	(k)	213,
801,444,000	729,375,000	72,069,000	32,935,935	(X e) 43,212,680	547,694,610	623,843,225	53,162,189	853,580			123,
268,618,910	263,569,130	5,049,780	29,666,653	50,213,379	112,054,827	191,934,859	0	17,686,150	8,339,616		50,
266,320,000	266,320,000	0	44,705,449	(X g) 18,409,960	69,902,005	133,017,414	4,363,950	(X i) 81,715,378			47,
113,107,669	100,123,813	12,983,856	595,910	0	57,578,603	58,174,513	0	10,114,783	28,882,801		15,
102,206,910	102,194,910	12,000	5,971,314	(X k) 7,366,639	67,790,771	81,128,724	4,781,872	993,153	384,226		14,
,930,891,584	2,840,776,948	90,114,636									
,227,879,772	2,220,502,872	7,376,900	81,460,093	92,966,056	876,489,625	1,050,915,774	306,446,750	405,485,471	13,798,872		451,
,157,886,980	1,484,640,187	673,246,793	(X n) 281,193,336	(c)	814,815,768	1,096,009,104	268,887,016	150,084,396	66,790,852		576,
,334,964,749	1,229,568,294	105,396,455									
770,836,349	767,795,900	3,040,449	10,332,009	67,820,072	366,694,543	444,846,624	24,937,650	6,241,550	(X p) 58,729,850		236,
708,450,887	652,131,452	56,319,435	(b) 125,714,806	(c)	419,792,256	545,507,062	(X r) 5,878,204		(X r) 58,898,711	(X t)	98,
623,690,150	461,772,394	161,917,756	25,490,509	29,059,502	360,161,348	414,711,359	4,985,429	74,536,481	7,472,553		121,
571,833,994	537,368,750	34,465,244									
521,136,258	222,657,800	298,478,458	68,311,578	121,681,940	242,922,096	432,915,614	0	61,985	2,582,740		
476,272,500	474,902,200	1,370,300	47,729,764	38,617,184	172,175,081	258,522,029	22,481,472	35,818,309	(X v) 60,476,213		98,
293,010,721	286,710,881	6,299,840	17,959,327	(X z) 10,728,979	53,913,945	82,602,251	0	151,467,577	3,126,242		55,
273,230,323	253,507,530	19,722,802	714,503	(X y) 9,131,942	172,934,590	182,781,035	0	11,732,203	1,808,227		76,
237,403,000	172,318,000	65,085,000	15,366,999	(Y b) 18,737,414	165,529,761	199,634,174	0	92,000			37,
232,848,275	223,455,275	9,393,000	51,042,803	39,169,606	47,550,371	137,762,780		3,263,550			26,
213,459,806	213,400,417	59,389	41,886,208	64,709,906	60,988,572	167,584,686	0	0	7,093,838		38,
195,791,000	192,439,000	3,352,000	(b) 45,502,000	(c)	85,494,000	130,996,000	1,122,000	10,864,000	6,907,000		
166,214,470	120,802,128	45,412,342	18,685,601	(Y e) 16,743,327	55,392,116	90,821,044	2,735,060	38,485,540			34,
128,836,865	112,482,785	16,354,080	(Y g) 22,710,213	(c)	63,960,632	86,670,845	7,046,801	5,171,140	2,241,664		27,
123,369,160	105,237,240	18,131,920	(Y i) 38,474,014	(c)	38,817,349	77,301,363	16,930,628	1,669,046	6,827,708		20,
,862,588,769	8,502,124,811	1,360,463,958									
,867,398,041	3,676,905,098	190,492,943									
,557,613,443	1,383,320,838	1,174,292,605	0	0	(Y o)	(Y o)	0	(Y o)	6,164,040		293,
,251,502,612	863,017,246	388,485,366									
410,327,600	410,327,600	0	(f)	(f)	(Y v) 365,860,280	365,860,280	0	3,467,320	0	(u)	41,
333,654,900	333,654,900	0									
324,993,710	324,993,710	0	(Y q) 98,283,233	(Y r) 123,861,938	39,052,583	261,197,754	0	3,698,300			60,
285,508,300	285,508,300	0	34,414,551	51,212,830	69,635,662	155,263,043	5,701,947	14,684,363	40,337,460		
241,355,956	184,885,956	56,470,000									
177,990,960	177,990,960	0	(b) 157,972	(c)	51,815,234	51,973,206	5,654,719	108,061,642	0		12,
144,638,800	140,962,000	3,676,800	(Y t) 25,252,400		99,554,607	124,708,007			817,000		19,
594,046,265	593,472,460	573,805	24,379,456	23,579,705	309,580,838	357,539,999	72,330,446	37,823,685			126,
,063,717,242	1,061,921,290	1,795,952	0	0	808,696	808,696	190,343,366	81,880	744,942,158	(Y z)	127,
581,706,072	0	(Z a) 636,552,764	0	0	259,658	259,658	24,557,196	0	28,719,506	(u)	58,
542,141,625	542,141,625	0	0	0	0	0	542,141,625	0	0		
390,915,742	82,835,023	308,080,719					82,835,023				
286,533,764	239,419,140	47,114,624	0	0	0	0	0	0	286,533,764		
257,696,595	257,696,595	0									
209,658,870	130,996,250	78,662,620	0	0	10,496,700	10,496,700	17,412,800	0	169,193,030		12,
205,649,608	205,603,658	45,950		(f)	(b) 41,296,437	41,296,437	23,350,597		137,487,311		3,
187,975,148	0	187,975,148									
140,216,985	98,318,323	41,898,662									
) 138,083,293	0	(Z c) 138,083,293									
131,186,730	131,186,730	0	0	0	71,227	71,227	10,799,200	244,987	106,801,078	(Z b)	13,
115,769,700	79,789,400	35,980,300									
111,341,210	98,662,510	12,678,700									
106,426,752	106,425,052	1,700									

1,155	25	13		(n) 39.7	43.0	59
11,385	0	33	1,256	42.7	47.1	60

(z z) Deliveries to railway department of company.
(44) Includes 4,151,331 kw.-hr. for street lighting.

									36,253	3,848		1,1
23,061,354		27,144,552	131,961,577	182,167,483	0	12,551,718	34,599,648		47,895,865	101,747	21,203	11,3
16,036,238		15,965,273	43,316,414	75,317,925	(NN) 6,522,956	167,115,155	4,357,481	(KK)	5,451,882	52,616	8,894	2,7
17,690,432		14,453,270	42,769,598	74,913,270		31,105,064	38,097,004		37,025,356	65,567	10,284	3,9
23,239,284	(AA)	27,824,030	109,513,814	160,577,128	(t)	(j) 49,147,084	2,047,187		26,235,339	68,309	(BB) 8,668	2,4
14,421,323	(EE)	20,944,653	127,527,513	162,893,489	25,457,848	4,177,858	2,484,886		32,476,130	43,347	(FF) 7,737	1,4
24,644,222		50,549,870	(DD) 73,482,119	148,676,211	0	9,396,160	10,046,609		39,948,621	69,702	9,214	1
0		0	0	0	0	159,719,174	0		5,369,136	0	0	
(b) 34,394,546		(c)	77,641,137	112,035,683	0	(GG) 22,079,956	13,487,900	(u)	17,329,281			
7,575,981	(LL)	11,415,893	89,288,052	108,279,926	2,016,810	5,235,076	6,002,267		29,101,036	27,052	5,380	1,5
7,709,632	(HH)	31,371,631	43,961,579	83,042,842	0	25,146,503	1,339,100		18,794,168	(II) 26,222	(c)	7
0		0	0	0	21,800,024	93,758,147	5,216,880		3,938,600	0	0	
5,867,504		9,964,684	56,250,733	72,082,921	3,730,393	9,912,605	588,804		37,317,621	17,667	3,304	1,6
10,287,192		10,718,860	76,109,825	97,115,877	261,330	8,248,540	132,013		11,921,474	30,111	5,430	1,3
										28,655	2,392	1,0
										(m) 282,863	(c)	(c)
89,712,204	(PP)	137,855,172	353,102,865	580,670,241	2,998,808	46,923,114	12,495,087		162,293,442	252,998	(QQ) 44,688	15,5
14,577,881	(RR)	39,325,337	218,639,938	272,523,156	17,524,719	37,394,640			72,382,822	37,169	(SS) 8,031	1,5
44,775,633	(TT)	61,917,848	188,821,686	295,515,167	257,643	20,520,176			48,877,885	95,887	(UU) 19,354	4,1
4,724,971		6,742,512	150,297,588	161,765,071		15,170,158	1,215,044		36,519,048	17,148	1,650	1,0
16,749,976	(XX)	24,948,754	101,654,797	143,353,527	8,222,288	9,882,900			32,958,785	43,149	(YY) 7,957	1,8
21,180,617	(ZZ)	34,592,368	88,551,181	144,324,166		25,554,281			17,174,353	47,880	(Aa) 7,195	1,5
15,062,672	(VV)	14,776,041	55,556,276	85,394,989	(w) 12,150,058	(i)	12,368,535		18,379,568	40,827	(WW) 4,164	2,8
(b) 158,165,817		(c)	(x) 1,346,112,573	(x) 1,504,278,390	(f)	(f)	(Dd) 105,332,226		356,783,382	(m) 206,419	(c)	(c)
19,056,891		23,390,850	345,010,041	387,457,782	5,557,340	119,321,627	42,143,540		99,331,918	64,198	18,010	5,1
0		0	0	0	0	428,265,885	(Nn) 11,114,115		0	0	0	
23,674,850	(Ee)	35,100,345	93,178,911	151,954,106	20,758,687	0			50,214,207	66,570	(Ff) 12,705	2,3
22,408,546	(Jj)	44,746,367	90,465,221	157,620,134	0	39,010,060	3,287,087		22,392,974	66,253	(Kk) 10,423	3,1
14,062,973	(Gg)	25,313,244	127,432,449	166,808,666	0	0	997,344		32,944,524	43,855	(Hh) 7,640	2,3
10,199,864		9,117,658	75,954,743	95,272,265	0	21,556,299	10,711,940		19,019,755			
12,001,571	(Ll)	39,636,484	33,243,859	84,881,914	32,318,331	0			20,585,755	32,408	(Mm) 7,140	1,4
										9,317	2,228	4
20,515,336	(Oo)	33,192,706	149,474,844	203,182,886	22,102,074	48,442,219			65,740,821	63,126	(Pp) 17,358	3,4
18,272,428	(Qq)	30,180,324	160,621,655	209,074,407	14,415,800	1,745,526			38,063,727	50,657	(Rr) 9,029	4,3
20,257,738	(Ss)	36,061,106	82,828,013	139,146,857	2,835,858	21,738,478	2,869,448		40,550,279	66,095	(Tt) 14,896	4,4
0		0	0	0	0	150,466,920			13,405,180	0	0	
18,734,802	(Uu)	27,428,143	56,966,605	103,129,550	42,831,202	1,103,285			12,366,713	48,864	(Vv) 6,522	1,8
9,776,813	(Ww)	15,350,327	70,294,491	95,421,631	0	41,192,800			21,179,946	27,295	(Xx) 4,019	6
9,228,079	(Yy)	21,386,762	60,500,073	91,114,914	587,453	12,323,423	17,432,709		30,450,291	34,498	(Zz) 10,467	2,1
0		0	0	0	0	122,937,000	0		0	0	0	
5,548,810		8,409,303	46,102,857	60,060,970	4,762,379	14,682,989	2,368,409		18,469,326	(m) 25,008	(c)	(c)
18,896,370	(Xa)	21,853,787	972,805,061	1,013,555,218	(Xb) 124,772,943	26,899,686	(k)	(h)	213,966,248	36,586	(Xe) 8,708	2,3
32,935,935	(Xe)	43,212,680	547,694,610	623,843,225	53,162,189	853,580			123,585,006	81,294	(Xf) 11,487	3,4
29,666,653		50,213,379	112,054,827	191,934,859	0	17,686,150	8,339,616		50,658,285	94,080	14,675	5,4
44,705,449	(Xg)	18,409,960	69,902,005	133,017,414	4,363,950	(Xi) 81,715,378			47,223,258	34,754	(Xh) 5,486	2,0
595,910		0	57,578,603	58,174,513	0	10,114,783	28,882,801		15,935,572	620	0	1
5,971,314	(Xk)	7,366,639	67,790,771	81,128,724	4,781,872	993,153	384,226		14,918,935	18,254	(Xl) 3,604	1,0
81,460,093		92,966,056	876,489,625	1,050,915,774	306,446,750	405,485,471	13,798,872		451,232,905	293,012	38,315	23,8
(Xm) 281,193,336		(c)	814,815,768	1,096,009,104	268,887,016	150,084,396	66,790,852		576,115,612	(Xo) 405,453		29,4
										(m) 143,216	(c)	(c)
10,332,009		67,820,072	366,694,543	444,846,624	24,937,650	6,241,550	(Xp) 58,729,850		236,080,675	(m) 62,747	(c)	(c)
(b) 125,714,806		(c)	419,792,256	545,507,062	(Xr) 5,878,204		(Xr) 58,898,711	(Xt)	98,166,910	(m) 119,059	(c)	(c)
25,490,509		29,059,502	360,161,348	414,711,359	4,985,429	74,536,481	7,472,553		121,984,328	48,589	8,757	12,8
68,311,578		121,681,940	242,922,096	432,915,614	0	61,985	2,582,740			174,586	(Xu) 23,263	7,9
47,729,764		38,617,184	172,175,081	258,522,029	22,481,472	35,818,309	(Xv) 60,476,213		98,974,477	79,915	8,647	2,8
17,959,327	(Xz)	10,728,979	53,913,945	82,602,251	0	151,467,577	3,126,242		55,814,651	14,766	(Ya) 3,346	8
714,503	(Xy)	9,131,942	172,934,590	182,781,035	0	11,732,203	1,808,227		76,908,867	14,224	(v) 3,977	4,4
15,366,999	(Yb)	18,737,414	165,529,761	199,634,174	0	92,000			37,676,826	18,857	(Yc) 4,463	1,1
51,042,803		39,169,606	47,550,371	137,762,780		3,263,550			26,041,595	(m) 85,841	(c)	(c)
41,886,208		64,709,906	60,988,572	167,584,686	0	0	7,093,838		38,781,282	107,852	19,033	6,2
(b) 45,502,000		(c)	85,494,000	130,996,000	1,122,000	10,864,000	6,907,000			30,186	3,698	1,2
18,685,601	(Ye)	16,743,327	55,392,116	90,821,044	2,735,060	38,485,540			34,172,826	35,190	(Yf) 7,436	3,3
(Yg) 22,710,213		(c)	63,960,632	86,670,845	7,046,801	5,171,140	2,241,664		27,706,415	(Yh) 33,667	(c)	6,1
(Yi) 38,474,014		(c)	38,817,349	77,301,363	16,930,628	1,669,046	6,827,708		20,640,415	(Yj) 56,292	(c)	3,2
0		0	(Yo)	(Yo)	0	(Yo)	6,164,040		293,475,119	0	0	(Yo)
										(d) 196,992	(c)	(c)
(f)		(f)	(Yv) 365,860,280	365,860,280	0	3,467,320	0	(u)	41,000,000	(f)	(f)	(Yw) 2,3
(Yq) 98,283,233	(Yr)	123,861,938	39,052,583	261,197,754	0	3,698,300			60,097,656	58,229	6,926	1,0
34,414,551		51,212,830	69,635,662	155,263,043	5,701,947	14,684,363	40,337,460			19,853	3,764	8
(b) 157,972		(c)	51,815,234	51,973,206	5,654,719	108,061,642	0		12,301,393			
(Yt) 25,252,400			99,554,607	124,708,007			817,000		19,113,793			
24,379,456		23,579,705	309,580,838	357,539,999	72,330,446	37,823,685			126,352,135	87,372	27,480	6,4
0		0	808,696	808,696	190,343,366	81,880	744,942,158	(Yz)	127,541,142			
0		0	259,658	259,658	24,557,196	0	28,719,506	(u)	58,170,607	0	0	
0		0	0	0	542,141,625	0	0					
					82,835,023							
0		0	0	0	0	0	286,533,764			0	0	
0		0	10,496,700	10,496,700	17,412,800	0	169,193,030		12,556,340	0	0	
		(f)	(b) 41,296,437	41,296,437	23,350,597		137,487,311		3,515,263			
0		0	71,227	71,227	10,799,200	244,987	106,801,078	(Zb)	13,270,238	0	0	
										20,779	4,683	7

1,155	25	13	.....	(n)	39.7	43.0		59
11,385	0	32	1,255		42.7	47.1		60
2,706	.....	56	1,170		59.2	.....		61
3,952	.....	.....	940	(n)	48.1	.....		62
2,448	(t)	(j) 15	2,020		47.7	38.4		63
1,461	3	5	3,100		58.0	(z)	63.9	64
154	0	3	1,880	(n)	47.3	49.0		65
0	0	4	.....		44.9	.....		66
.....	.....	.....	.....	.....		56.2		67
1,540	1	9	3,200	(r)	51.7	(z)	50.7	68
.....	.....	.....	.....	(CC)	56.3	86.5		69
726	0	4	3,085	(n)	52.2	.....		70
0	3	3	.....		44.4	(z)	44.1	71
1,694	2	5	3,185		44.8	.....		72
1,370	.....	.....	2,635		48.8	(zp)	49.0	73
1,016	5	2	.....	(n)	50.4	.....		74
.....	.....	.....	.....	.....		.....		.....
(c)	(c)	(c)	.....	(m)	54.9	(n)	51.2	75
15,553	5	99	1,855		53.3	50.0		76
1,566	2	4	5,840	(n)	52.9	(n)	56.9	77
4,105	20	11	2,475	(p)	57.0	(p)	52.7	78
1,056	.....	4	8,150		39.5	(n)	29.6	79
1,836	5	2	2,720	(n)	50.0	(n)	55.5	80
1,554	.....	4	2,550	(n)	55.0	(n)	53.8	81
2,801	(w) 9	(i)	1,785		47.3	.....		82
.....	.....	.....	.....	.....		.....		.....
(c)	(c)	(c)	.....		56.0	.....		83
5,174	.....	.....	4,440		56.5	53.9		84
0	0	1	.....		48.8	.....		85
2,304	3	0	1,865	(n)	38.6	(n)	46.8	86
3,151	0	3	1,980	.....		43.7		87
2,351	0	0	3,100	(n)	55.0	(n)	52.7	88
.....	0	.....	.....		49.0	.....		89
1,472	2	0	2,065	(n)	43.2	(z)	40.4	90
461	1	.....	.....	(n)	46.7	.....		91
.....	.....	.....	.....	.....		.....		.....
3,471	5	31	2,425	(n)	50.3	(n)	68.6	92
4,318	1	5	3,270	(n)	53.6	(n)	53.8	93
4,416	4	28	1,630		47.3	(n)	40.1	94
0	0	3	.....	(n)	79.1	(z)	72.0	95
1,837	1	4	1,805	(n)	51.9	(n)	73.8	96
697	0	1	2,980	(n)	34.5	(n)	61.0	97
2,184	1	5	1,935	(n)	39.8	.....		98
0	0	3	.....	(n)	41.3	.....		99
(c)	(c)	(c)	2,400		57.1	.....		100
.....	.....	.....	.....	.....		.....		.....
2,309	(Xd) 5	14	21,300		84.2	81.8		101
3,427	6	6	6,490	(n)	76.2	67.3		102
5,456	0	13	1,680		46.5	(z)	48.1	103
2,039	1	10	3,160	(n)	63.5	(n)	63.5	104
177	0	1	73,000	(n)	52.2	.....		105
1,065	.....	2	3,540		58.3	.....		106
.....	.....	.....	.....	.....		.....		.....
23,819	5	14	2,960	(n)	60.3	(n)	56.5	107
29,403	11	20	2,520	(n)	60.5	64.1		108
(c)	(c)	(c)	.....	(n)	60.6	.....		109
(c)	(c)	(c)	.....		62.1	67.4		110
(c)	.....	.....	4,580		60.0	53.1		111
12,838	2	5	5,900		54.7	72.5		112
.....	.....	.....	.....		66.9	55.6		113
7,929	0	1	2,110		49.5	49.7		114
2,868	9	11	2,830	(r)	45.8	51.1		115
801	0	8	4,370		50.0	54.0		116
4,469	0	.....	8,080	(n)	62.1	(n)	62.6	117
1,106	0	3	8,190	(n)	61.0	56.2		118
(c)	.....	(c)	1,600		44.3	38.2		119
6,270	0	0	1,260		35.7	33.5		120
1,229	1	3	3,730		55.5	52.7		121
3,376	3	3	1,925	(n)	68.7	53.2		122
6,102	3	1	2,180	.....		(n)	53.7	123
3,265	1	2	1,300		45.4	(z)	51.8	124
.....	.....	.....	.....	.....		.....		.....
.....	.....	.....	.....	(Ym)	62.8	(n)	63.8	125
(Yo)	0	(Yo)	.....		74.4	69.8		126
(c)	.....	.....	6,360		56.6	62.9		127
(Yw) 2,300	0	.....	(u) 159,000		74.0	.....		128
.....	.....	.....	.....		49.3	43.8		129
1,011	0	1	3,940		54.5	47.4		130
859	.....	.....	6,370		52.4	(z)	51.5	131
.....	.....	.....	.....		51.8	.....		132
.....	.....	.....	.....		50.9	.....		133
.....	.....	.....	.....	(Yu)	63.5	(z)	48.5	134
6,491	2	6	2,940		68.0	.....		135
.....	.....	.....	.....		42.8	30.3		136
36	2	0	.....	(r)	36.6	(n)	38.6	137
.....	.....	.....	.....		43.5	39.2		138
.....	.....	.....	.....		37.1	38.0		139
0	0	0	.....	(o)	36.8	39.5		140
.....	.....	.....	.....		32.6	34.3		141
.....	.....	0	.....	(Br)	45.6	(zr)	47.7	142
.....	.....	.....	.....	(r)	36.8	(n)	39.7	143
.....	.....	.....	.....		46.5	52.7		144
.....	.....	.....	.....		33.1	28.4		145
.....	.....	.....	.....	.....		.....		146
5	8	1	.....		35.0	(n)	34.4	147
.....	.....	.....	.....	(r)	51.8	.....		148
706	1	.....	.....	(n)	50.1	.....		149
.....	.....	.....	.....		45.0	.....		150

(z) Deliveries to railway department of company.
(AA) Includes 4,151,331 kw.-hr. for street lighting.
(BB) Includes 82 street lighting customers.
(CC) Based on average for maximum eight-hour shift.
(DD) Includes 165,206 kw.-hr. miscellaneous.
(EE) Includes 7,146,921 kw.-hr. municipal sales.
(FF) Includes 128 municipal customers.
(GG) Includes 6,558,434 kw.-hr. municipal light and power and 15,521,522 kw.-hr. street lighting.
(HH) Includes 18,868,590 kw.-hr. municipal sales.
(II) Includes commercial and municipal customers.
(JJ) Includes Wisconsin River Power Co., Southern Wisconsin Power Co. and Central Wisconsin Power Co.
(KK) Includes distribution loss and company use.
(LL) Includes 2,828,094 kw.-hr. municipal sales.
(MM) Includes Milwaukee Electric Railway & Light Company, Wisconsin Gas & Electric Company, Wisconsin Traction, Light & Power Company, Peninsular Power Company, Milwaukee Northern Railway Company and Wisconsin Electric Power Company.
(NN) Transferred to electric railways.
(OO) Includes Union Electric Light & Power Company (Missouri), Union Electric Light & Power Company of Illinois, East St. Louis & Suburban Company, Mississippi River Power Company, and Central Mississippi Valley Electric Properties. (St. Louis, Mo.)
(PP) Includes 31,029,970 kw.-hr. municipal sales.
(QQ) Includes 473 municipal customers.
(RR) Includes 24,533,144 kw.-hr. municipal sales.
(SS) Includes 713 municipal customers.
(TT) Includes 12,746,516 kw.-hr. for street lighting and building.
(UU) Includes 349 street lighting and building customers.
(VV) Includes 6,147,032 kw.-hr. municipal sales.
(WW) Includes 12 municipal customers.
(XX) Includes 6,877,349 kw.-hr. municipal sales.
(YY) Includes 70 municipal customers.
(ZZ) Includes 5,897,900 kw.-hr. municipal sales.
(Aa) Includes 1 municipal customer.
(Bb) Includes 2 standby plants.
(Cc) Also 16 plants with total generator rating of 319,280 kva. available by lease or contract.
(Dd) Includes 84,954,841 kw.-hr. intra-company railway business.
(Ee) Includes 10,742,346 kw.-hr. municipal sales.
(Ff) Includes 60 municipal customers.
(Gg) Includes 3,774,211 kw.-hr. municipal sales.
(Hh) Includes 169 municipal customers.
(Ii) Includes Madison Light & Power Company.
(Jj) Includes 7,054,694 kw.-hr. municipal sales.
(Kk) Includes 2 municipal customers.
(Ll) Includes 4,784,751 kw.-hr. municipal sales.
(Mm) Includes 10 municipal customers.
(Nn) Energy used for construction work, operation of camp and plant, and at U. S. Nitrate Plants Nos. 1 and 2.
(Oo) Includes 17,929,231 kw.-hr. municipal sales.
(Pp) Includes 427 municipal customers.
(Qq) Includes 15,215,160 kw.-hr. municipal sales.
(Rr) Includes 19 municipal customers.
(Ss) Includes 10,019,143 kw.-hr. municipal sales.
(Tt) Includes 354 municipal customers.
(Uu) Includes 3,943,462 kw.-hr. municipal sales.
(Vv) Includes 5 municipal customers.
(Ww) Includes 8,025,929 kw.-hr. municipal sales.
(Xx) Includes 5 municipal customers.
(Yy) Includes 5,506,243 kw.-hr. municipal sales.
(Zz) Includes 113 municipal customers.
(Xa) Includes 5,997,779 kw.-hr. municipal sales.
(Xb) Includes 116,132,454 kw.-hr. for electrified railroads.
(Xc) Includes 286 municipal customers.
(Xd) Includes 3 electrified railroads.
(Xe) Includes 11,946,732 kw.-hr. municipal sales.
(Xf) Includes 230 municipal customers.
(Xg) Includes 7,330,583 kw.-hr. municipal sales.
(Xh) Includes 282 municipal customers.
(Xi) Includes power interchanged with other companies.
(Xj) Five plants four months, six plants eight months.
(Xk) Includes 1,405,416 kw.-hr. municipal sales.
(Xl) Includes 29 municipal customers.
(Xm) Includes Great Western Power Company of Cal., San Joaquin Light & Power Corp. and Midland Counties Public Service Corp.
(Xn) Includes commercial lighting, 23,560,951 kw.-hr. for street lighting and 32,420,505 kw.-hr. for heating and cooking.
(Xo) Includes commercial, 2,891 heating and cooking and 8,909 combination lighting, heating and cooking customers.
(Xp) Deliveries to San Joaquin Light & Power Corp. over tie line connecting both systems.
(Xq) Also 4 plants with total generator rating of 13,600 kw. available by contract.
(Xr) Distributed to company's railway, steam heat, gas and water departments with attendant losses.
(Xs) Includes distribution losses.
(Xt) Transmission and conversion losses.
(Xu) Also 91 customers reported under "intra-company business."
(Xv) Includes 57,378,145 kw.-hr. for company railway system.
(Xw) Includes Nevada-California Power Company and Yuma Utilities Company.
(Xy) Includes 3,578,699 kw.-hr. municipal sales.
(Xz) Includes 1,449,360 kw.-hr. municipal sales.
(Ya) Includes 25 municipal customers.
(Yb) Includes 1,631,854 kw.-hr. municipal sales.
(Yc) Includes 84 municipal customers.
(Yd) 37,000 kva. first half year.
(Ye) Includes 4,144,022 kw.-hr. municipal sales.
(Yf) Includes 67 municipal customers.
(Yg) Includes commercial lighting and 3,095,306 kw.-hr. municipal sales.
(Yh) Includes commercial and 17 municipal customers.
(Yi) Includes commercial lighting and 369,753 kw.-hr. municipal sales.
(Yj) Includes commercial and 19 municipal customers.
(Yk) Also included under North American Co. (Cal. Properties System). Omitted from total for Pacific States to avoid duplication.
(Yl) Includes also Ontario Power Co. and Toronto Power Co.
(Ym) Peak load over twenty-minute period.
(Yn) Includes subsidiary and purchased power plants.
(Yo) Total output sold in bulk to power customers and distributing companies.
(Yp) Includes output of Vancouver Island Power Co. and Western Power Co. of Canada.
(Yq) Includes 77,454,251 kw.-hr. for heating.
(Yr) Includes energy to Manitoba Power Commission; includes 95,031,329 kw.-hr. for heating.
(Ys) Includes Manitoba Power Company, Ltd.
(Yt) Includes also commercial lighting, electric railways and other public utilities.
(Yu) Peak load over ten-minute period.
(Yv) Estimated, includes residential and commercial lighting.
(Yw) Includes residential and commercial customers.
(Yx) Includes Ottawa River Power Company.
(Yz) Energy used by power houses, shops, yards, loss in transmission and conversion, used by substation auxiliaries.
(Za) Energy purchased measured on a.c. side, output measured on d.c. side.
(Zb) Includes conversion.
(Zc) Energy consumed.

* **Data received too late for inclusion in the table.** Add these to totals given.

* Salem Electric Lighting Company, 1 fuel plant, 34,375 kva. Total output, 100,874,562 kw.-hr.; generated, 100,857,900 kw.-hr.; purchased, 16,662 kw.-hr. Sales: light and power, 29,062,390 kw.-hr.; 10,458 customers; electric railways, 5,711,400 kw.-hr.; other public utilities, 60,067,000 kw.-hr. Intra-company business, 4,190,596 kw.-hr. Line losses, 1,843,175 kw.-hr. Consumption per customer, 2,780 kw.-hr. 1926 load factor (n) 43.3 per cent

* Cumberland County Power & Light Company, 1 fuel plant, 28,125 kva.; 5 hydro plants, 21,500 kva. Total output, 107,971,800 kw.-hr.; generated 101,072,300 kw.-hr.; purchased, 6,899,500 kw.-hr. Sales: residential, 9,387,125 kw.-hr., 33,873 customers; commercial, 14,553,063 kw.-hr. 5,582 customers; power, 37,429,753 kw.-hr., 2,789 customers; electric railways, 1,278,011 kw.-hr., 1 customer, other public utilities, 7,182,990 kw.-hr., 5 customers. Intra-company business, 17,811,991 kw.-hr. Line losses, 20,328,867 kw.-hr. Consumption per customer, 1,455 kw.-hr 1926 load factor, (q) 41.5 per cent.